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US Army Corps
of Engineers
Fort Worth District

Embankment Criteria and Performance Report

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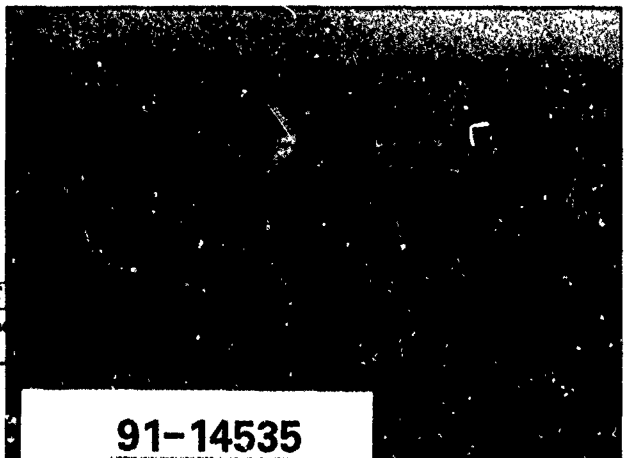
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
TRINITY RIVER BASIN



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DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

REPLY TO
ATTENTION OF:

CESWF-ED-G

9 October 1991

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SUBJECT: Joe Pool Lake, Texas, Embankment Criteria and Performance Report

In accordance with paragraph 8 of ER 1110-2-1901, the subject report is transmitted for your use and information.

FOR THE COMMANDER:

Encl

FOR

R. TERRY COOMES, P.E.
Chief, Engineering Division

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Statement A per telecon Vicky Sharp
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JOE POOL LAKE

MOUNTAIN CREEK, TEXAS

TRINITY RIVER BASIN

EMBANKMENT CRITERIA

AND

PERFORMANCE REPORT

U.S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

FORT WORTH, TEXAS

MAY 1991

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT CRITERIA AND PERFORMANCE REPORT

SECTION I - INTRODUCTION

1-01. Authority. - Authority for preparing Embankment Criteria and Performance Reports is contained in ER 1110-2-1901; Subject: Embankment Criteria and Performance Report, dated 31 December 1981.

1-02. Purpose. - The purpose of the report is to provide the information needed to (1) familiarize engineers with the project, (2) re-evaluate the earthen embankment and appurtenant structural features in the event of unsatisfactory performance, and (3) provide guidance for designing comparable future projects.

1-03 Authorization and Purpose of the Project. - Joe Pool Lake (formerly Lakeview Lake) was authorized by the River and Harbor Act of 1965, approved 27 October 1965 (Public Law 89-298) in accordance with the plan of improvement as outlined in House Document 276 (89th Congress, 1st Session) The purpose of the project is flood control, water supply, general recreation, and fish and wildlife enhancement

1-04. Project Maintenance. - The project is operated and maintained by the U S. Army Corps of Engineers, Fort Worth District (CESWF). Joe Pool Dam is inspected annually by the Operations Division and inspected periodically by the Engineering Division in accordance with the Corps of Engineers program of "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures", ER 1110-2-100, dated 8 April 1988

1-05. History of Project Design - The overall design of the Joe Pool Lake was presented in Design Memorandum No 4, General, dated December 1969. The design of the outlet works was presented in Design Memorandum No. 24, Outlet Works, dated November 1978. The feature design for the Joe Pool Lake embankment and spillway was presented in Design Memorandum No. 9, Embankment and Spillway, dated April 1980. All of these Design Memoranda were reviewed and approved by the Southwestern Division and the Office, Chief of Engineers.

SECTION II - PROJECT DESCRIPTION

2-01. General. - Joe Pool Lake is located on Mountain Creek, a tributary to the West Fork of the Trinity River, Texas, in southwest Dallas County near Grand Prairie and extends into Tarrant and Ellis Counties The watershed is southwest of Dallas with a length of approximately 37 miles and lies within parts of Dallas, Tarrant, Ellis, and Johnson Counties. The dam site is located in Dallas and Tarrant Counties at river mile 11.2, on Mountain Creek, about 7.1 miles upstream from Mountain Creek Dam. The location of the project is shown on plate 1. A general plan of the embankment and dike is shown on plate 2, and typical embankment sections are shown on plates 3 and 4. Major structures at the project include an earthfill embankment, an outlet works (plates 5 through 10), a spillway (plates 11 through 16), and a dike The embankment and dike are rolled earthfills totaling approximately 24,340 feet in length The limited service spillway consists of an uncontrolled rectangular broadcrested weir with a crest length of 50 feet The outlet works consists of excavated approach and discharge channels, intake structure and service bridge, a 660-foot long by 10.5-foot diameter cut-and-cover conduit, and a stilling basin

2-02. Pertinent Data.

a. Embankment and Dike.

(1) Type - Earthfill

(2) Embankment length - 22,180 feet

(3) Dike length - 2,160 feet

(4) Maximum height - 108.5 feet above streamed

(5) Embankment crest width - 30 feet

(6) Top elevation - 564.5 feet (NGVD)

(7) Total Volume of Fill - 12.7 million cubic yards (approximate)

b Spillway.

(1) Type - Uncontrolled rectangular broadcrested weir, limited service

(2) Length of Crest - 50 feet

(3) Crest Elevation - 541 0 feet (NGVD)

(4) Capacity (@559 4 feet NGVD) - 11,900 cfs

c. Outlet Works.

(1) Type - Gated conduit

(2) Conduit Diameter - 10.5 feet

(3) Conduit Length - 660 feet

(4) Control - Two 4 75 x 10 5 foot gates

(5) Capacity (@559.4 feet NGVD) - 4,500 cfs

d Drainage Area - 232 square miles

e Reservoir Data.

Feature	Elevation (feet NGVD)	Area (Acres)	Acre-Feet	Equivalent Runoff (Inches)
Top of Dam	564.5	--	--	--
Maximum Water Design Surface	559.4	18,600	642,400	51.92
Spillway Crest	541.0	12,470	36[illegible]00	29.31
Top of Flood Control Pool	536.0	10,940	304,000	24.57
Top of Conservation Pool	522.0	7,470	176,900	14.30
Maximum Tailwater (at dam site)	471 6	--	--	--
Streambed	456.0	--	--	--

SECTION III - GEOLOGY

3-01. <u>General Physiography</u> - The Joe Pool Dam is located in the Eagle Ford Prairie subdivision on the West Gulf Coastal Plain section of the Coastal Plain physiographic province The major topographic feature in the area is the White Rock escarpment which is located approximately one-half mile east of the dam's right abutment This escarpment has a vertical relief of about 200 feet, trends north-northeast, and marks the western extent of the Austin Chalk Formation. Immediately west of the escarpment are numerous remnants of a small cuesta. The cuesta was formed by a resistant limestone bed of the Eagle Ford Formation which was subsequently eroded into series of sub-rounded hills rising some 30 to 60 feet above the present Mountain Creek floodplain. Topographically, the Joe Pool Dam is characterized by a moderately steep right (east) abutment formed by one of the above mentioned "Eagle Ford" hills, a relatively flat 5,000-foot wide floodplain and a gently rising left (west) abutment.

3-02. General Geology. - Bedrock strata underlying the embankment and reservoir area consists of Upper Cretaceous sediments belonging to the Eagle Ford Formation. Lithologically, the Eagle Ford strata include a variety of rock types, but consists predominantly of soft to moderately hard clay shale. The formation outcrops in a 15-mile wide belt striking approximately north-south through northeast Texas. The regional structure of the strata is monoclinal with a gentle dip to the southeast. The Eagle Ford Formation has a thickness of 600 feet near Sherman, Texas. However, the formation thins considerably to the south and has a maximum thickness of 225 feet at Joe Pool Dam An areal geology map is presented on plate 24.

3-03. Geology of the Dam Site. - A detailed description of the geology, as determined through foundation mapping of excavations during construction, are presented in the Final Foundation Reports for the Outlet Works, and the Embankment and Spillway. The following are excerpts therefrom.

a. Description of the Overburden. - Overburden consisting of Quaternary age alluvial and terrace deposits cover all bedrock at the dam site with the exception of some isolated areas on the right abutment where weathered bedrock has been exposed by hillside erosion. The deposits consist predominantly of clay, with heterogeneous assortments of silt, sand, and gravel either mixed in or occurring separately Overburden materials encountered during preconstruction investigations and observed during construction in the shallow inspection trench were predominantly clays, sandy clays, and gravelly clays. Impure sand and gravel deposits are generally found near the base of the overburden unit. Along the embankment centerline, the thickness of the overburden ranged from 3 feet at station 69+50 to a maximum of 55 feet in a suspected buried stream channel at station 15+00. A geologic profile along the embankment centerline is presented on plates 25 through 29.

In the valley section of the embankment, between stations 17+00 and 65+00, the overburden consists of Recent floodplain deposits having an average thickness of 45 feet. In general, these deposits consist of 35 to 40 feet of medium to high plasticity clay underlain by 5 to 10 feet of semi-impervious clayey sand and gravel immediately overlying bedrock. Excavations within this unit in the vicinity of the old Mountain Creek channel (station 53+00 to 56+00) encountered pockets of organic materia s and some water-bearing sand and gravel zones

Quaternary terrace deposits mantle the bedrock from about station 65+00 to the west end of the dam. These deposits consist of sandy clay and clayey sand. Fairly clean sand with some gravel was noted from station 72+00 to 75+00. This area was formerly the site of an old abandoned gravel pit Average thickness of the terrace deposits is about 30 feet

b <u>Bedrock Stratigraphy.</u> - Primary strata beneath the dam site belong to the Britton member of the Eagle Ford Formation, Upper Cretaceous in age. Thickness of the Eagle Ford ranges from about 80 feet at the west end of the dam to approximately 250 feet at the right abutment Immediately underlying the Eagle Ford are the interbedded sand and clay shale strata of the Woodbine Formation.

The Britton member, which is the lowest (oldest) member of the Eagle Ford Formation, is divided into three units based on lithology. In ascending order they are (1) the Lower Britton, Unit I; (2) the Lower Britton, Unit II, and (3) the Upper Britton. During construction of the dam, strata belonging to the Upper Britton Unit were exposed in excavations for the spillway, the diversion channel and drop structure, the outlet works, and in the deep inspection trench at the right abutment. The Lower Britton, Unit II, was exposed during excavation for the outlet works stilling basin. None of the construction excavations penetrated the Lower Britton, Unit I.

Along the embankment alignment, beds of the Upper Britton Unit lie directly beneath the overburden between stations 0+00 and 45+00, and from station 63+00 to 113+00. Overburden is supported by strata of the Lower Britton, Unit II, from station 45+00 to 63+00, and between stations 113+00 and 168+00. From station 168+00 to the west end of the embankment, overburden is underlain by beds belonging to the Lower Britton, Unit I. The bedrock units dip southeastward resulting in the older strata occurring nearer the surface progressively westward, and the contacts between the units occurring at greater depths as they progress eastward. A geologic profile along the embankment centerline showing the bedrock stratigraphy is presented on plates 25 through 29.

c. Bedrock Structure. - The regional structure of the Eagle Ford Formation is monoclinal with dip of the strata to the east-southeast at approximately 50 feet per mile. In the area of Joe Pool Lake and eastward toward Dallas, strata of the Eagle Ford Formation and the overlying Austin Chalk Formation are extensively faulted. The majority of the faults are normal faults, occurring as a result of consolidation and differential settlement of individual beds. Typical displacement across a fault line is normally less than 15 feet. Several small displacement faults were noted in the area of Joe Pool Lake, either by direct observation within excavation areas, or as inferred from preconstruction electric log interpretations and 6-inch core sample inspection A discussion of bedrock faulting examined in the major excavation area follows:

(1) Right Abutment Deep Inspection Trench. - Subsurface investigations during design along the dam site centerline at the right abutment revealed that the top of bedrock dropped abruptly into the floodplain due to the erosion and curving action of an ancient buried stream channel located at the base of the abutment. The buried channel contained a maximum of 55 feet of alluvium and colluvium consisting of clay with variable amounts of sand, gravel, shale, and limestone fragments. The right abutment was also investigated as a potential site for the outlet works and spillway structures. However, these investigations revealed the presence of a large bedrock slump block, consisting of highly jointed, fractured brecciated shale. The slump block is located downstream of the embankment centerline in the area where the outlet works stilling basin would be located. Rather than requiring deep excavations through unstable bedrock for the outlet works and spillway stilling basins, both structures were resited to their present locations

As a result of these discoveries during early investigations, the decision was made to deepen the inspection trench at the right abutment so that any unstable bedrock or highly permeable channel deposits encountered could be treated and/or removed. The deep inspection trench, located between embankment stations 8+50 and 19+00, was designed to penetrate to bedrock and disclose any pervious materials in the buried stream channel. The design slopes of the trench were 1V on 3H, resulting in a maximum trench width of 420 feet, exposing a large surface area of bedrock for inspection. A geologic map and profile of the deep inspection trench is shown on plate 30.

The deep inspection trench was closely inspected by geotechnical personnel from CESWF and CESWD after the bottom of the trench had reached elevation ±458, approximately 19 feet above the design excavation grade. Materials observed in the bottom of the trench consisted of unweathered clay shale of the Upper Britton member of the Eagle Ford Formation, an area of stiff, moist, brown alluvial clay, and a small pocket (less than 10 feet across) of very gravelly clay (described as colluvial material on preconstruction boring logs). The contact between the clay shale and the alluvial clay was very distinct and vertically oriented, reflecting a buried vertical face in the bedrock which occurs at embankment centerline station 14+30. During the inspection, the decision was made to immediately terminate excavations in the deep inspection trench and start backfilling. The decision was based on the conclusion that the primary materials exposed in the floor of the trench were competent and the colluvial materials comprising the buried stream channel were sufficiently impervious so that stability and leakage through the embankment foundation would not be a problem. The materials in the buried stream channel were predominantly clay and gravelly clay which will preclude detrimental seepage. Although some minor faulting was present in the exposed clay shale, the bedrock generally appeared competent and in much better condition than the bedrock encountered by borings in the slump block area downstream of the embankment.

(2) Outlet Works and Spillway. - Geologic profiles of the outlet works and spillway are presented on plates 31 and 32, respectively. Detailed bedrock descriptions are presented in the above referenced foundation reports

SECTION IV - FOUNDATION CONDITIONS

4-01. General. - The embankment is founded on a clay overburden which overlies shale of the Eagle Ford Group The overburden is composed primarily of CH and CL clays with interbedded strata of clayey sands, clayey gravels and silty sands. The shale is generally soft (rock classification) increasing to moderately hard with depth, jointed, fractured, calcareous and contains numerous bentonite seams and lenses. Engineering parameters for the embankment, outlet works and spillway foundations are included in the profiles and sections shown on plates 37 through 47.

4-02. Floodplain Embankment Foundation.

a. The floodplain embankment foundation from station 2+60 to station 9+00 consists of up to 10 feet of CH and CL clay overburden overlying weathered shale. The weathered shale ranges from 10 to 20 feet thick, is calcareous, very soft to soft, and exhibits lower shear strength characteristics than do the overburden materials. The weathered shale overlies soft to moderately hard unweathered shale that contains bentonite seams and numerous low to high angle joints and fractures

b. The floodplain embankment foundation from station 9+00 to about station 20+00 includes CH and CL clay overburden materials generally ranging in thickness from about 5 feet to about 40 feet One boring in this area indicated that overburden extended to the top of unweathered shale which was at a depth of approximately 57 feet. This boring also revealed a possible buried stream channel filled with deposits of sandy, gravelly clay However, construction of a deep inspection trench in this area revealed only insignificant amounts of clay-choked gravel.

c. The embankment foundation in the floodplain from about stations 20+00 to 60+00 consists of 25 to 45 feet of overburden lying directly on unweathered Eagle Ford shale The overburden is predominantly CH clay with lesser amounts of CL clay, clayey sands and clayey gravel. The unweathered shale is calcareous, soft to hard, fractured and contains bentonite seams up to 1 foot thick. From about station 60+00 to station 68+00 the topography rises, and the thickness of the overburden decreases to about 15 feet, but still overlies unweathered primary. The overburden in this reach is predominantly CH and CL clays transitioning to predominantly clayey and silty sands toward station 74+00.

d. Overburden clays in the floodplain between about station 25+00 and 64+00 exhibit a weaker lower section; i.e., weaker than the overlying clays. The weaker clay stratum is saturated, and overlies sandy and gravelly clays.

4-03. Outlet Works Foundation. - The overburden along the embankment centerline varies from about 15 feet of primarily clayey and silty sands at station 73+20 to about 25 feet of CH and CL clays at station 81+00. The primary materials along this reach are weathered shale overlying unweathered shale. The shale is soft to moderately hard, jointed, calcareous, and contains bentonite seams.

4-04. Left Embankment Foundation. - The left embankment foundation from station 82+00 to station 224+40 is predominantly a CH and CL clay overburden ranging in thickness from about 10 feet to about 50 feet. In general, the clay overburden is calcareous, sandy, and contains discontinuous strata of sands and gravels. The overburden is supported by weathered shale that transitions into unweathered shale.

4-05. Dike Foundation. - The dike foundation from station 228+00 to station 249+60 is similar to the left embankment foundation described above, except overburden thickness averages about 20 to 25 feet.

4-06. Spillway Foundation. - The spillway was constructed on compacted fill, overburden soils, and primary materials The overflow structure is founded on compacted embankment fill, while the chute is founded on either compacted fill, overburden, or primary materials, depending upon location. The spillway stilling basin was constructed entirely on primary materials. Compacted fill under the spillway consisted of CL clay materials having a liquid limit range of 30 to 45 with a maximum thickness of approximately 14 feet. Overburden materials in this area consisted of approximately 15 feet of stiff to hard CL and CH clays. The primary materials are composed of up to 25 feet of weathered shale overlying unweathered shale containing numerous high-angle fractures and bentonite seams.

SECTION V - EMBANKMENT DESCRIPTION

5-01. General. - Joe Pool Dam consists of a rolled earthfill embankment and dike with typical sections and general plan as shown on plates 2 and 3 The embankment and dike consist mainly of clays and were constructed under three contracts as described in Section Construction. Clay shale and other primary materials from required excavations were allowed in the semi-compacted zones; however, clay shales comprised only a small percentage of the total volume The embankment and dikes have lengths of 22,180 and 2,160 feet, respectively, and a maximum height above streambed of 108.5 feet. The crest width is 30 feet for the embankment (which supports a public roadway) and 10 feet for the dike (which supports a service road).

5-02. Embankment Zoning.

a. Impervious Fill. - Materials in the central impervious fill zone consist of clay material excavated from borrow areas. Clays for the impervious fill were limited to CH and CL materials with liquid limits equal to or greater than 40, having not less than 60 percent by weight passing the No 200 sieve, and containing no rock or stone particles greater than 3 inches in any dimension. The materials were placed in 8-inch maximum loose lifts at moisture contents after compaction between optimum and 3 percent above optimum. The impervious zone of the embankment consists of a total of approximately 2.8 million cubic yards, or about 22 percent of the entire dam.

b. Random Fill. - The random fill zones of the embankment are symmetrically located adjacent to the impervious zone, and are composed of materials excavated from the designated borrow areas. Random fill was limited to materials classified as overburden materials (e.g., CL, CH, and SC) containing no rock or stone particles greater than 6 inches in any dimension. The fill was specified to be placed in 8-inch maximum loose lifts at moisture contents after compaction between 2 percent below optimum and 3 percent above optimum. The random fill zones of the embankment consist of a total of approximately 4.8 million cubic yards, or about 38 percent of the entire dam.

c. Semi-Compacted Fill. - The semi-compacted fill zones are symetrically located adjacent to the random zone, and are composed of materials obtained from required excavations and borrow areas. The materials for the semi-compacted fill included both overburden and primary materials containing no rock or stone greater than 10 inches in any dimension. The fill was specified to have 10-inch (initial contract) or 12-inch (completion contract) maximum loose lifts for compaction with rubber-tired rollers. During construction, the contractors were optionally allowed to use 8-inch maximum lifts for compaction with tamping rollers The required moisture content after compaction was between 2 percent below optimum and 3 percent above optimum in the initial contract, and 5 percent below optimum and 4 percent above optimum in the completion contract. The semi-compacted zones of the embankment consist of a total of approximately 4 3 million cubic yards, or about 34 percent of the entire dam.

d. Select Impervious Fill. - Materials in the select impervious fill zone consist of clay materials excavated from borrow areas. Select impervious fill was limited to materials having liquid limits of 30 to 45 (inclusive) under the spillway for the initial contract. Elsewhere a 30 to 60 (inclusive) range was used in both the initial and completion contracts. Select impervious fill was also limited to materials containing no rock or stone particles greater than 3 inches in any dimension and a moisture content after compaction of optimum to 3 percent above optimum. The select impervious fill zones of the embankment consist of a total of approximately 0 7 million cubic yards, or about 6 percent of the entire dam.

5-03. Dike. - The dike is composed of materials excavated from the designated borrow areas of the road relocation contract. Fill was limited to overburden materials having no rock or stone greater than 3 inches in any dimension The dike was specified to have a moisture content within 2 percent below optimum to 3 percent above optimum. The contractor was allowed to use 8-inch maximum loose lifts for tamping-type rollers or 10-inch maximum loose lifts for pneumatic type rollers. The dike volume is comparatively very small and will not be quoted here.

5-04. Borrow. - Borrow areas were located upstream of the embankment and below the proposed conservation pool elevation (plate 19) During the initial contract, borrow areas B-1, C-1, E-2, and E-4 were made available for usage During the completion contract, all borrow areas were available, but only areas A, B-1, C-1, D-1, D-2, E-1, and E-3 were actually utilized. Most of these areas were only partially exhausted of usable materials Borrow Area A was the most extensively used area by the completion contractor and his excavations were not only deeper than anticipated, they were extended riverward at his request outside the defined limits. Approximately 1.8 million cubic yards or about 18 percent of the entire fill quantity that was required for the contract was obtained outside the designated borrow areas. Because of a claim during construction partly involving availability of materials, the borrow areas were surveyed to record excavation extent. The resulting topographic information is presented on plates 20 and 21. Similar information concerning extent of excavation is presented in profile format on plate 22. The excavation depth exceeded 40 feet in some areas.

5-05. Slope Protection.

a. Riprap and stone protection for the upstream slopes are as follows:

(1) Twelve inches of stone protection was placed on the 1 vertical on 2.8 horizontal upstream slope above elevation 543.0.

(2) Twenty-four inches of riprap on 9 inches of bedding was placed on the 1 vertical on 5 horizontal slope of the outlet works embankment from elevation 512 to elevation 543 and from station 72+00 to station 82+00

(3) Twenty-four inches of riprap on 9 inches of bedding was placed from station 99+13 to station 100+87 (adjacent to the spillway) and from natural ground to elevation 564 5

b. Riprap for the outlet works is as follows:

(1) Thirty-six inches of riprap on 6 inches of bedding over filter cloth was placed from outlet works station 27+40 to outlet works station 28+85 from the training walls up to elevation 474.

(2) Thirty-six inches of riprap on an 18-inch two-stage transitional filter bedding (12 inches on 6 inches) was placed from outlet works station 28+85 to outlet works station 29+60, in the channel bottom to and up the slopes to elevation 474

(3) Twenty-four inches of riprap on 9 inches of bedding was placed in the outlet works discharge channel from outlet works station 29+60 to outlet works station 31+35, in the channel bottom and up the slopes to elevation 474.

c. Riprap for the spillway is as follows:

(1) Thirty-nine inches of riprap on 6 inches of bedding on filter cloth was placed along the spillway from the walls up to elevation 509.0 and from spillway station 12+45 to spillway station 14+10.

(2) Thirty-nine inches of riprap on an 18-inch two stage transitional filter bedding (12 inches on 6 inches) was placed along the discharge channel from spillway station 14+10 to spillway station 14+45, in the channel bottom and up the slopes to elevation 509.0

(3) Twenty-four inches of riprap on 9 inches of bedding was placed along the spillway discharge channel from spillway station 14+45 to spillway station 16+70, in the channel bottom and up the slopes to elevation 509 0.

5-06. Closure Plan. - Embankment closure was made between approximate stations 39+50 and 62+50 The closure plan included the diversion channel, the channel plugs and the cofferdams as shown in plan and profile on plate 48.

a Diversion Channel. - The diversion channel and closure section provided passage for flows of Mountain Creek during construction prior to the embankment closure The following elements were included in the plan.

(1) The diversion channel had a bottom width of 40 feet at approximate elevation 458 and 1 vertical on 4 horizontal side slopes

(2) Excavation for the diversion channel was entirely in overburden materials.

(3) During embankment closure, the diversion channel was excavated

throughout to sound material (plate 49) and backfilled according to embankment zoning.

b. Channel Plugs. - Three plugs were constructed in the closure area (plate 48) Details are given below.

(1) Each plug was built outside the embankment limits to an elevation equivalent to the adjacent natural ground.

(2) The plugs had approximately 12-foot crown widths, symmetrical 1 vertical on 4 horizontal slopes, and were constructed using random-type fill materials.

(3) The plugs located upstream of the embankment in Mountain Creek diverted flows through the diversion channel during construction of the main embankment and during river cleanout (plate 49).

(4) The plug located in the diversion channel upstream of the embankment diverted flows through the outlet works and provided some flood protection for the upstream cofferdam construction.

(5) A diversion channel plug downstream of the embankment provided protection for the closure area after the cofferdam was constructed upstream.

c. Cofferdam. - A cofferdam consisting of random-type fill material was constructed in the diversion channel at the upstream limit of the embankment (plate 48).

(1) The cofferdam had approximately a 12-foot wide crown and formed a permanent portion of the main embankment.

(2) The upstream cofferdam had approximate slopes of 1 vertical on 8 horizontal from elevation 499.5 down to elevation 488 0, 1 vertical on 3 horizontal down to elevation 468.0 and 1 vertical on 4 horizontal down to the bottom of the diversion channel.

(3) The upstream cofferdam provided protection for construction of the embankment in the closure area against a flood with an average recurrence interval of 10 years with 5.0 feet of freeboard (or 25 years with no freeboard). No overtopping occurred.

SECTION VI - EMBANKMENT DESIGN

6-01. General. - The design analyses of the embankment was divided into typical sections including the floodplain, outlet works, spillway, and left abutment. The following paragraphs provide a brief review of the field investigations, including sampling, laboratory testing, design data, and the stability analyses. The typical embankment sections are shown on plates 3 and 4

6-02. Field Investigations. - The dam foundation was investigated using auger, shelby, Denison and core barrel samplers. Calyx holes were also utilized in the vicinity of the right abutment. Borrow areas were investigated using auger borings. From these borings, both disturbed and relatively undisturbed samples were obtained for conducting laboratory tests The plans of borings for the embankment, dike, outlet works, and spillway are shown on plates 33 through 36.

6-03. Laboratory Testing. - Selected samples from the field investigations were tested in the laboratory to evaluate the engineering properties of the foundation and the fill The tests included index tests, classification, unconfined compression, direct shear, residual (or steady state) and pre-split residual direct shear, triaxial Q, R, and S tests, and consolidation-expansion tests. Remolded samples from the borrow areas were subjected to the aforementioned tests in order to simulate fill conditions, while undisturbed samples were used from the dam foundation areas. Engineering parameters, as depicted in profiles and sections through the embankment and related structures, are shown in plates 37 through 47.

6-04. Embankment Design Data. - Based on field investigations, laboratory testing and engineering judgment, the parameters adopted for embankment design and analyses are as tabulated below. Assumed parameters for the overburden and primary are listed in the order found relative to natural grou..

a. Overburden.

Moist unit weight	129 pcf
Saturated unit weight	130 pcf

Type Strength	Cohesion, tsf	Angle of internal Friction, ø, degrees
Q	1.0	1.0
R	0 3	13 0
S	0.0	20.0

b. Weak Overburden

Moist unit weight	124 pcf
Saturated unit weight	125 pcf

Type Strength	Cohesion, tsf	Angle of internal Friction, ø, degrees
Q	0.6	0.0
R	0.3	13.0
S	0 0	20.0

c. Sand and Gravel Stratum

Moist unit weight	132 pcf
Saturated unit weight	132 pcf

Type Strength	Cohesion, tsf	Angle of internal Friction, ø, degrees
S	0.0	30 0

d. Primary

Moist unit weight	125 pcf
Saturated unit weight	130 pcf

	Type Strength	Cohesion, tsf	Angle of internal Friction, ø, degrees
(shale)	S	0.5	18.0
(bentonite)	S	0.0	18.0

e. Borrow. - Design unit weights and shear strengths listed below were selected based on placement of compacted clay borrow materials at 95% Standard density and a moisture content of optimum plus 3 percent. For the purpose of stability analyses, no distinction was made between the shear strengths of the various zones of the embankment.

Moist unit weight	125 pcf
Saturated unit weight	129 pcf

Type Strength	Cohesion, tsf	Angle of internal Friction, ø, degrees
Q	0.7	1.5
R	0 1 - 0.2	12.0
S	0 0	20 0

6-05. Seepage Analyses

a. General. - The Joe Pool embankment was constructed of medium, but mostly high plasticity, erosion and piping resistant, impervious materials The embankment was designed and constructed to preclude any detrimental through or under seepage Seepage analyses, as described in the following paragraphs, revealed that no underseepage control methods were necessary. A deep inspection trench was included at the right abutment to evaluate the condition and secondary permeability of the colluvium and clay shales No problems were discovered and, in fact, the trench was terminated at a higher level than anticipated due to the competency and impervious nature of the materials being encountered

b. Embankment, Station 2+60 to Station 80+00. - The embankment from the right abutment to about station 80+00 will be the only reach which will be subject to a constant head of water since natural ground elevation for the remainder of the embankment is above conservation pool. Due to the impervious nature of the embankment, coupled with the long seepage paths, it is expected that the embankment would not be saturated and that no detrimental underseepage would develop. A deep inspection trench was excavated on the right abutment to allow evaluation of the secondary permeability of the weathered shale on the abutment and of the colluvial material in the supposed buried channel at the abutment base. A description of the excavation is presented in Section III - Geology.

c. Embankment, Station 80+00 to Station 224+40. - The embankment west of about station 80+00 will be subject to very infrequent reservoir pools Natural ground along this reach is above conservation pool elevation Due to the transient, short duration inundation of the impervious embankment, little saturation of the embankment will occur.

d. Foundation. - Potential underseepage was analyzed during design using three flownets. A number of conservative and simplifying assumptions were made to facilitate easier flownet construction. The various assumptions are listed on the referenced plates.

(1) Buried Channel. - The supposed buried channel located at the base of the right abutment near station 14+50 was believed to be partially filled with colluvium. Since the permeability of the colluvium would be greater than the overlying clays, it was conservatively assumed that the colluvium existed from natural ground to the channel bottom. Actually, the colluvium was believed to fill only a small part of the channel and was covered by a 20-foot blanket of impervious clay. Horizontal and vertical permeabilities for the colluvium were conveniently assumed to be equal A k-

value of 1 x 10^{-4} cm/sec was assumed. Based on this conservative assumption, the analysis presented on plate 50, the seepage quantity for conservation pool elevation is estimated to be less than 3 gal/day per linear foot of dam. The computed exit gradients are 0.06 with the reservoir at conservation pool and 0.15 at the maximum design water surface. Both exit gradients are low and fall well below the maximum desired range of 0.3 to 0.4. Thus, a deep trench was not needed except for inspection and evaluation of secondary permeability. As discussed earlier, actual construction revealed that no problem exists.

(2) Right Abutment. - Underseepage potential through the right abutment was analyzed as shown on plate 51. The primary and overburden were assumed to be clay. The overburden and the weathered primary material were assumed to be the only potential seepage paths; i.e., the unweathered primary and the compacted embankment fill were assumed to be impervious. The ratio of k-horizontal to k-vertical was assumed equal to 25 with k-horizontal being equal to 1 x 10^{-8} cm/sec. Computed underseepage rates based on these assumptions are 6 x 10^{-4} gal/day per linear foot of embankment for conservation pool conditions. Seepage exit gradients were computed to be 0.11 for conservation pool, and 0 34 for maximum design water surface. Thus, underseepage design measures were not necessary.

(3) Floodplain. - Underseepage potential in the floodplain was estimated using a section at the deepest portion of the valley as shown on plate 51. The analysis assumed overburden was entirely clay and that it and the weathered primary are the only materials through which seepage can occur, i.e., unweathered clay shale and compacted fill were assumed to be impermeable. The horizontal permeability was assumed to be 25 times larger than the vertical permeability with k_h equal to 10^{-8} cm/sec With the

reservoir at conservation pool, the computed seepage quantity is 1.6 x 10^{-3} gal/day per linear foot of embankment. The maximum computed exit gradient for conservation pool is 0.16. The computed exit gradient at maximum design water surface is 0.27. Thus, underseepage control measures were not needed.

(4) Conclusions. - Underseepage and through seepage quantities are estimated to be negligible. Exit gradients calculated are all well below accepted maximum values and calculated underseepage quantities are very small Since the flownets were drawn using conservative assumptions with regard to foundation material isotropy, permeability and stratigraphy, the seepage control afforded by the design is adequate.

e. Spillway. - Seepage design considerations for the spillway are discussed in paragraph 6-07. Additionally, finite element analyses were conducted at the Waterways Experiment Station to evaluate steady state (plate 52) and transient (plates 54 and 55) lines of seepage at this embankment section.

(1) Steady state seepage at or below the conservation pool elevation 522.0 is the most realistic line of seepage, if any, that can occur (plate 52). Since conservation pool will be below the embankment base, no through seepage will develop. Seepage exit gradients were computed to be 0.22 or less along the spillway underdrain system. Seepage quantities were computed to be 0.0003 gallon per day per linear foot of embankment

(2) Transient lines of seepage through the embankment were estimated assuming the longest duration of reservoir pool at higher elevations based on the pool duration curves shown on plate 53. The results of these finite element analyses are shown on plate 54 and verify judgment that the pool durations above conservation pool are too short to cause saturation of

the impervious embankment. Thus, embankment through seepage conditions do not apply.

(3) Steady state lines of seepage at pools higher than conservation pool are not considered likely. However, they were estimated and are presented on plate 55.

6-06. Stability Analyses. - The stability of the various embankment sections was evaluated using circular arc and wedge methods. The embankment was conveniently divided into sections for engineering purposes with stability analyses conducted for the floodplain, outlet works, and left embankments (plates 3 and 4). The analyses included both computer and manual methods in accordance with criteria in EM 1110-2-1902, Stability of Earth and Rock Fill Dams, dated 1 April 1970 A large portion of the stability analyses during design were performed using a crest elevation of 563.0; however, the crest elevation was later raised to 564 5. The increase of 1.5 feet in the top of dam resulted in minimal changes in the computed safety factors; therefore, not all analyses were rerun. The following tables show the results of the stability analyses conducted during design for the conditions of: (1) end of construction (with and without 50 percent excess pore pressure), (2) steady seepage, and (3) partial pool.

FLOODPLAIN EMBANKMENT
TABLE 6-1

Condition	Shear Strength	Type of Analysis	Elevation of Failure Plane ft, NGVD	Safety Factor Computer:Manual		Footnotes
Floodplain embankment, station 2+60 to 70+00 (1 vertical on 8 horizontal slopes, crest elevation 564.5)						
End of Construction	Q	Wedge	436	1.23:	-	4
End of Construction	Q,S	Wedge	435	1.52:	-	1,3
End of Construction	Q,S	Wedge	430	1.41:	1.40	1,6
(1 vertical on 10 horizontal slopes, crest elevation 563.0)						
Steady seepage	S,$\frac{R+S}{2}$	Wedge	436	2.13:	-	4,7
Steady seepage	S,$\frac{R+S}{2}$	Wedge	468	2.20:	-	2,7
Partial pool	S,$\frac{R+S}{2}$	Wedge	468	2.01:	-	2

FOOTNOTES

1 50% excess pore water pressure in foundation
2 Failure plane through base of embankment
3. Failure plane through overburden
4 Failure plane through weak overburden
5. Failure plane through shale
6. Failure plane through bentonite seam
7 Conservation pool elevation 522 0
8. Surcharge pool elevation 557.5
9. Through spillway

OUTLET WORKS EMBANKMENT
TABLE 6-2

Condition	Shear Strength	Type of Analysis	Elevation of Failure Plane ft, NGVD	Safety Factor Computer:Manual	Footnotes
			Outlet works embankment, station 73+20 to 81+00 (crest elevation 563.0)		
End of construction	Q	Circular Arc	496	2.93 : 2.93	3
End of construction	Q,S	Wedge	495	1.96 : -	1,5
End of construction	Q,S	Wedge	494.5	1.34 : 1.36	1,6
End of construction	Q,S	Wedge	496	1 40 -	1,3
Steady seepage	S, $\frac{R+S}{2}$	Circular Arc	496	1 50 : -	7
Steady seepage w/surcharge pool	S, $\frac{R+S}{2}$	Circular Arc	496	1 50 : 1.50	8
Partial pool	S, $\frac{R+S}{2}$	Circular Arc	515	1.42 : -	7

FOOTNOTES

1. 50% excess pore water pressure in foundation
2. Failure plane through base of embankment
3. Failure plane through overburden
4. Failure plane through weak overburden
5. Failure plane through shale
6. Failure plane through bentonite seam
7. Conservation pool elevation 522 0
8. Surcharge pool elevation 557.5
9. Through spillway

LEFT EMBANKMENT

TABLE 6-3

Condition	Shear Strength	Type of Analysis	Elevation of Failure Plane ft. NGVD	Safety Factor Computer:Manual	Footnotes
Left embankment, station 82+00 to 224+40 (crest elevation 563.0)					
End of construction	Q	Circular Arc	505	3.40 : -	3
End of construction	Q,S	Wedge	505	1.45 : 1.43	1,3
End of construction	Q,S	Wedge	504	1.97 : -	1,5
End of construction	Q,S	Wedge	503.5	1.35 : 1.37	1,6
Steady seepage	S, $\frac{R+S}{2}$	Circular arc	525	1.47 : 1.47	2,7
Steady seepage	S, $\frac{R+S}{2}$	Circular arc	505	1.50 : -	3,7
Steady seepage w/surcharge pool	S, $\frac{R+S}{2}$	Circular arc	525	1.47 : -	2,8
End of construction	Q	Circular Arc	460	2.92 : -	5,9
End of construction	Q,S	Wedge	459	1.54 : 1.55	1,6,9

FOOTNOTES

1. 50% excess pore water pressure in foundation
2. Failure plane through base of embankment
3. Failure plane through overburden
4. Failure plane through weak overburden
5. Failure plane through shale
6. Failure plane through bentonite seam
7. Conservation pool elevation 522.0
8. Surcharge pool elevation 557.5
9. Through spillway

a. Sudden Drawdown. - Pool elevation probability and duration curves for Joe Pool Lake (plate 53) indicate that the reservoir will stay at or below conservation pool elevation 522 approximately 90 percent of the time, and at or below elevation 530 approximately 99 percent of the time. Further, average pool recurrence interval curves indicate that elevation 530 has a 15.5-year recurrence interval, and elevation 538.5 has a 100-year interval. The sudden drawdown condition is therefore not considered applicable as it is unrealistic that pool durations at the higher elevations would cause saturation of the highly impervious embankment materials. Thus, analyses assuming sudden drawdown conditions were not performed.

b. Stability of the Floodplain Embankment.

(1) End of Construction. - The wedge method was used to analyze the floodplain embankment assuming end-of-construction conditions; i.e., water table located at natural ground and using Q-strength in the embankment and foundation. The minimum calculated factor of safety was 1.23 (by computer) for the embankment section having 1 vertical on 8 horizontal slopes and a crest elevation of 564.5. A factor of safety less than the 1.3 was deemed satisfactory by CESWD in an Endorsement to the General Design Memorandum.

(2) End-Of-Construction With Excess Pore Pressure. - The floodplain embankment was analyzed using the wedge method assuming end of construction conditions with 50 percent excess pore pressure in the foundation; i.e., groundwater at natural ground, Q-strength in the embankment, S-strength in the foundation overburden and primary, and a positive excess pore water pressure head in the foundation equal to the height of the embankment. For embankment slopes of 1 vertical on 8 horizontal, a crest elevation of 564 5, and assuming failure planes through the weak overburden

and bentonite seams, the computer factors of safety were 1.52 and 1.41, respectively. A manual check of the last safety factor gave a value of 1.40 for the failure plane passing through the bentonite seam (plate 56).

(3) Steady Seepage. - The following analyses were performed assuming embankment crest elevation 563.0 and 1 vertical on 10 horizontal slopes.

(a) The floodplain embankment was analyzed assuming steady seepage conditions developed at conservation pool elevation 522 (plate 57). The wedge method was used and a minimum factor of safety of 2.13 was calculated for a failure surface along the base of the weak overburden clays. Failure surfaces along the base of the embankment at natural ground were also investigated, and a local minimum factor of safety of 2 20 was calculated.

(b) The floodplain embankment was not analyzed assuming steady seepage conditions with a surcharge pool. The analyses discussed in paragraph (a) above has a sufficiently high computed factor of safety to eliminate performing this analysis; i e., experience indicates that analyses assuming short duration surcharge pools do not produce critical calculated factors of safety for embankment geometries like Joe Pool.

(4) Partial Pool. - The floodplain embankment was analyzed using the wedge method assuming crest elevation 563 0, 1 vertical on 10 horizontal slopes, and partial pool conditions (plate 57). A minimum factor of safety of 2.01 was calculated for a failure plane along the base of the embankment crest with the critical pool elevation being 520. Manual calculations were not performed for this analysis.

c Stability of the Outlet Works Embankment. - The following analyses were performed assuming embankment crest elevation 563.0.

(1) End of Construction. - The outlet works embankment section with crest elevation 563.0 was analyzed using the circular arc method assuming end-of-construction conditions; i.e., water table at natural ground and Q-strength in the embankment and foundation. A minimum computed factor of safety for a circular arc failure tangent to the base of overburden was 2.93 (plate 58). Investigation of other tangent elevations revealed very similar calculated factors of safety. For example, a local minimum factor of safety of 2.94 was calculated for circles passing tangent to the base of the embankment.

(2) End of Construction With Excess Pore Pressure. - The outlet works embankment section with crest elevation 563.0 was analyzed using the wedge method assuming end of construction conditions with 50 percent excess pore pressure in the foundation; i.e., groundwater at natural ground, Q-strength in the embankment and S-strength in the foundation overburden and primary, and an induced excess pore water pressure head in the foundation equal to the height of the embankment. A local minimum factor of safety of 1.96 was calculated for wedge failures through the shale (plate 33). The minimum factor of safety calculated was 1.34 for a wedge through a bentonite seam using ϕ = 18 degrees for the bentonite. Manual calculations for the failure plane passing through the bentonite seam gave a calculated factor of safety of 1.36 (plate 59).

(3) Steady Seepage. - The steady seepage condition controls the design of the downstream slope of the outlet works embankment section.

(a) The outlet works embankment section with crest elevation 563.0 was analyzed using the circular arc method assuming steady seepage conditions developed at conservation pool elevation 522, and the lower cohesion value for

R-strength. The phreatic surface was conservatively simulated as a straight line from its entry point to the downstream toe. The minimum factor of safety calculated by the computer and manual methods was 1.50 for a circle passing tangent to the base of the foundation overburden (plate 60). A local minimum factor of safety of 1.53 was also calculated for a circle passing tangent to the base of the embankment.

(b) The outlet works embankment crest elevation 563.0 was further analyzed using the circular arc method assuming steady seepage conditions developed at conservation pool elevation 522, but with a surcharge pool at elevation 557.5. This analysis did not produce a lower calculated factor of safety than described above.

(4) Partial Pool. - The outlet works embankment section with a crest elevation of 563 was analyzed assuming partial pool conditions using circular arc failure surfaces. Failure tangent to the base of the embankment produced lower calculated factors of safety than did failure through the overburden. Therefore, failure tangent to the base of the embankment will be discussed in detail.

(a) A computer analysis was performed assuming failure surfaces tangent to the base of the embankment using 0.1 tsf as the cohesive portion of the R-strength. The search process showed the most critical circle to be centered at x and y coordinates 140 and 740, respectively, a critical pool at elevation 534, and a calculated factor of safety of 1.26. Since this critical pool is 12 feet above conservation pool elevation 522, the pool duration would be short. Thus, the horizontal line of seepage at this high an elevation assumed in the computer analysis is unrealistically conservative. A manual analysis was performed on the above described critical circle, but assuming the cohesive portion of the R-strength as 0.2 tsf and a line of seepage more appropriate for a short duration pool at elevation 534. Using these assumptions, the calculated factor of safety is 1.42 (see figure 1, plate 61).

(b) The computer analysis was then rerun using 0.2 tsf as the assumed cohesive portion of the R-strength. The results showed that the critical circle location shifts to x and y coordinates 120 and 680, respectively, and the critical pool shifts to spillway crest elevation 536 (see plate 61, figure 2). As shown in figure 2, the two critical circles of discussion are very similar. Further, they have calculated factors of safety differing by only 0.02. Therefore, a manual analysis was not performed.

(c) The computer analysis was again rerun assuming a constant pool elevation 522 and the higher value of cohesion for R-strength. The grid of computed factors of safety showed the critical circle to shift to x and y coordinates 160 and 800, respectively, with the minimum value being 1.47. Even though this analysis assumed a horizontal line of seepage, it is considered to be a realistic analysis Figure 3 on plate 61 presents the results of this computer analysis, and, figure 2 presents all three critical circles so that a visual comparison can be made.

(d) Summarizing, the outlet works embankment section was analyzed assuming partial pool conditions. Several analyses were performed using various assumptions. The most realistic assumptions yielded a calculated factor of safety of 1.42 or higher for failure surfaces tangent to the base of the embankment with pool elevations 522 or higher.

d. Stability of the Left Embankment. - The following analyses were performed assuming embankment crest elevation 563 0.

(1) End-of-Construction. - The circular arc method was used to

analyze the left embankment assuming end-of-construction conditions; i.e., water table at natural ground and Q-strength in embankment and foundation. The minimum calculated factor of safety was 3.40 for a failure plane passing tangent to the base of embankment. Manual analyses were not performed for these assumptions.

(2) End of Construction With Excess Pore Pressure. - The left embankment was analyzed using the wedge method assuming end of construction conditions with 50 percent excess pore pressure in the foundation; i.e., groundwater at natural ground, Q-strength in the embankment and S-strength in the foundation overburden and primary, and a positive excess pore water pressure head in the foundation equal to the height of the embankment. Failure planes were assumed to pass through the overburden, shale, and bentonite seam (ϕ = 18 degrees) in the shale. The computer factors of safety were 1.45, 1.97, and 1.35, respectively. A manual check was made for the first and third cases. These factors of safety were 1.43 (plate 62) and 1.37 (plate 63), respectively.

(3) Steady Seepage.

(a) The left embankment was analyzed by the circular arc method assuming steady seepage conditions developed at conservation pool elevation 522. A minimum factor of safety of 1.47 was calculated for a failure surface through the base of the embankment (plate 64) A local minimum factor of safety of 1.50 was calculated for a failure surface through the overburden.

(b) The left embankment was further analyzed assuming steady seepage conditions developed at conservation pool elevation 522, and a surcharge pool at elevation 557 5 These conditions resulted in a computed factor of safety of 1 47 for a circular failure plane passing through the base of the embankment (plate 64). Subsequent to these analyses, the maximum design water surface elevation was changed to elevation 559.4. Analyses were not rerun.

e. Stability of the Spillway at the Left Embankment No. 2.

(1) General. - Stability analyses for a section through the spillway at embankment station 100+00 were conducted for end of construction conditions as described below.

(2) End of Construction. - The circular arc method was used to analyze failure through the spillway channel assuming end of construction conditions; i.e., water table at natural ground and Q-strength in the embankment and foundation. The minimum calculated factor of safety was 2.92 for a failure plane passing through the shale. Manual calculations were not performed for these assumptions.

(3) End of Construction With Excess Pore Pressure. - The spillway was analyzed using the wedge method assuming end of construction conditions with 50 percent excess pore water pressure in the foundation. The analyses assumed excess pore water pressures in the foundation and a failure plane through a bentonite seam in the shale. The minimum calculated factors of safety were 1.54 by computer and 1 55 by manual methods (plate 65)

6-07. Spillway Foundation Design. - The spillway foundation is unique in that the spillway was designed to be founded on compacted medium plasticity ($30 \leq LL \leq 45$) clays rather than directly on undisturbed foundation materials. Through-seepage will be controlled due to the features discussed below that have been incorporated into the design and construction of the spillway foundation

a. Differential settlement can create cracking in compacted fill materials and it can destroy a desired water-tight concrete-fill interface. In either case, a path for movement of water can be created. Features incorporated into the spillway design to reduce or contend with differential settlement are:

(1) The left embankment No. 2 (spillway foundation) was constructed using medium plasticity clay materials. This type of fill material is not only impervious, but it should exhibit a higher degree of volumetric stability.

(2) The first contract provided for the construction of the left embankment No. 2 to full height. This allowed for foundation settlement to occur at a non-critical time; thus, differential and total settlement after construction of the spillway under the completion contract was reduced because the foundation was preloaded by the embankment built under the first contract This preloading was very successful in accomplishing the settlement ahead of spillway construction as shown on plates 91 and 92

(3) A positive contract pressure between the embankment fill and the concrete U-frame walls of the overflow structure was desirable To encourage this continuous contract, the walls were designed with a positive batter so that the fill can wedge against the walls and tend to cause the walls and fill to move together as a unit.

b. An embankment filter drainage system was included as an extra measure to intercept, collect and discharge any embankment through seepage The chimney portion of the drain extends to elevation 560 and provides protection slightly higher than the maximum design water surface elevation

6-08. Spillway Foundation Design Data. - Based on field investigations, laboratory testing, and engineering judgment, the parameters adopted for use in the foundation design of the structural concrete portion of the spillway were as follows:

Embankment fill and overburden
Unit weight = 125 pcf
c = 400 psf ø = 23 degrees
Allowable bearing capacity = 3.0 KSF

Non-expansive backfill
Unit weight = 130 pcf
c = 0 ø = 30 degrees

Shale
Unit weight = 130 pcf
c = 400 psf ø = 12 degrees
Anchor pullout resistance: 2.0 KSF for the case of assuming full tailwater with impervious blanket failed. 0.8 KSF for the case of assuming full tailwater with impervious blanket intact.
Allowable bearing capacity = 5.0 KSF

Backfill
Unit weight = 125 pcf (except nonexpansive)
Earth pressure coefficients (k):
Within embankment: K-effective = 0.75 (horizontal backfill)
Outside embankment: K-effective = 0.50 (horizontal backfill)
Throughout: K-effective = 1.0 (sloping backfill)

The pullout resistance parameters for anchor design were adopted to compensate for the severe uplift conditions assumed; i.e., to achieve a realistic anchoring scheme. Anchor pull-out tests were performed during construction to confirm the assumed capacity.

VII - CONSTRUCTION

7-01. General. - The embankment, outlet works, spillway and associated structures were constructed under two main contracts. The dike was constructed as part of a relocation of roads contract.

7-02. Overview of Contracts. - The pertinent details for the construction contracts are listed below:

a. Outlet Works and Initial Embankments. - The initial contract included an initial floodplain embankment to elevation 514 0 from station

27+00 to station 49+00; a pre-load embankment to elevation 564 5 from station 95+00 to station 105+00 (spillway location); the outlet works tower and associated structures, except for the service bridge, and portions of the outlet works approach and discharge channels. A plan showing the areas of work in the initial contract is presented on plate 2.

b. Completion of Embankment, Spillway and Outlet Works. - During the completion contract, the major work performed included completion of the earthfill embankment, except for the dike which had already been built under a contract for Relocations of Roads, construction of the outlet works service bridge, construction of the spillway, and construction of the roadway on top of the embankment. Other work that was performed during the completion contract included construction of a drop structure near the spillway and completion of the outlet works approach and discharge channels

c Relocation of City Streets and County Roads, Road Relocation No. 1, Part I. - During this road relocation contract, the major work performed was the construction of a road that crosses the dike. Also included in this contract was the construction of a small portion of the embankment, station 217+75 to station 223+65, and the dike on the west end of the embankment, station 228+67 to station 249+60.

7-03. Contract Data

a Outlet Works and Initial Embankments

(1) Contract No - DACW63-80-C-0009

(2) Contractor - The Lane Construction Corp, Meriden, CT

(3) Contractor's Bid - $11,200,632.50

(4) Notice to Proceed - 6 Dec 79 (acknowledged)

(5) Actual Completion Date - 4 Jun 82

b. Completion of Embankment, Spillway, and Outlet Works.

(1) Contract No. - DACW63-81-C-0191

(2) Contractor - Servidone Construction Corp, Castleton, NY

(3) Bid Price - $25,781,338.18

(4) Notice to Proceed - 18 May 82 (acknowledged)

(5) Actual Embankment Completion Date - Sep 85±

c. Relocation of City Streets and County Roads, Road Relocation No. 1 - Part I.

(1) Contract No. - DACW63-82-C-0092

(2) Contractor - H.B. Zachary Co., Grand Prairie, Texas

(3) Bid Price - N/A

(4) Notice to Proceed - 28 Jun 82 (acknowledged)

(5) Actual Completion Date - 7 Feb 84

7-04. Contract Fill Estimates (Approximate). -

a. Outlet Works and Initial Embankments

(1) Impervious	0.75 million cubic yards
(2) Select Impervious	0.16 million cubic yards
(3) Random	0.91 million cubic yards
(4) Semi-Compacted	1.33 million cubic yards
Total	3 15 million cubic yards

b Completion of Embankment, Spillway and Outlet Works

(1) Impervious	2.05 million cubic yards
(2) Select Impervious	0.54 million cubic yards
(3) Random	3.94 million cubic yards
(4) Semi-Compacted	2.98 million cubic yards
Total	9.51 million cubic yards

c Relocation of City Streets and County Roads No. 1, Part I. - The dike portion of the embankment was constructed as an unzoned, uniform fill. Fill quantity was small and is, therefore, not summarized herein.

7-05. Embankment Construction Equipment. - The equipment used for the construction of the embankment was similar for both of the main contracts. The specification governing compaction equipment was based on the Civil Works Construction Guide Specification CW-02212. The following subparagraphs provide general information on the embankment construction equipment.

a. Excavating and Hauling Equipment. - During both contracts, the primary methods of excavating borrow materials was with Holland loaders and scrapers. The Holland loaders were used to fill scrapers and belly dumps. In addition, during the completion contract, end dumps were used to haul fill.

b. Processing and Compacting Equipment. - Fill materials were processed on the fill using a fleet of equipment including 36-inch diameter discs, graders, water wagons and dozers. The materials were always processed by discing to either achieve uniform moisture or to achieve breaking up and blending. If discing was performed to achieve uniform moisture, none was required for breaking up and blending. Compaction during both contracts was primarily accomplished using sheepsfoot rollers

7-06. Foundation Protection. - The clay shales encountered at this site deteriorates and degrades to clay if allowed to undergo cycles of wetting and drying. To contend with this, the contracts required timely excavation and protection by covering final surfaces within specified times. Each contract included an excavation staging/phasing for the purpose of protection of final clay shale surfaces as shown on plate 18 for the outlet works and plate 17 for the spillway. These controls were adequate and enforceable.

7-07. Construction Problems.

a. General. - The inherent properties that make CL and CH clays desirable for use in an embankment also produce characteristics that make them tough and hard to manage. Every phase of the production process, from excavation to placement, processing, compaction and preserving the in-place moisture content can be a frustrating, but normal experience. The materials used on this project are some of the toughest that can be found for the liquid limit ranges involved in that they plot near to and paralleling the U-line on a plasticity chart. At low moisture contents, they can be hard and dusty, and upon wetting become sticky, slick, stiff to soft and muddy. At all moisture levels encountered in the construction process, these fat clays form chunks or clods of sizes dependent somewhat on the excavation method. While clod size was not a problem with respect to acceptability, a layer of fill left "open" on the fill usually created severe moisture control problems. During both contracts, moisture control was considered by the contractors to be their major problem. This is understandable because in-place moisture was the main acceptance criteria Both contractors routinely chose to perform moisture adjustment on the fill rather than at the borrow. However, when used, moisture adjustment at the borrow worked very well, especially when done in conjunction with scraper excavation operation The lack of selectivity in the borrow including mass vertical face excavation using Holland loaders nearly always created layers of fill having wet and dry areas. Thus, watering the layer on the embankment put water on the materials not needing water, and the opposite problem occurred when discing for the purpose of assisting the drying process was performed When a layer of material is left open after either having been disced or freshly dumped, individual chunks of material upon drying form crusts. Water sprayed onto the fill at any rate faster than a fine mist quickly flows off the chunks and accumulates at the bottom of the loose layer. Thus, trying to solve the problem of dry, crusted materials in one area can create an entire under-laying of materials that are too wet. Though this is not an uncommon situation on any high plasticity embankment job, it seemed that on this one, especially the completion contract, that the lesson had to be learned over and over again. Additional problems for each contract are discussed below.

b. Initial Contract.

(1) During the initial contract, it became apparent that the availability of select impervious fill materials having a 30 to 45 liquid limit range without an unreasonable amount of selective borrowing was a problem. Designers from CESWF and CESWD jointly agreed that the problem should be solved by expanding the definition of select impervious fill so as to allow materials with liquid limit ranges from 30 to 60 for all locations except for the spillway foundation The contract was modified accordingly.

(2) Shortage of water for spraying onto the fill, combined with record high temperatures, became a problem during the summer of 1980. The contractor resorted to pumping water from the Mountain Creek Lake which is located downstream of this project.

(3) Completion Contract. - The major problems associated with this contract from the contractor's point of view was moisture control. This is understandable since moisture was the main acceptance criterion. From the Government's point of view, one of the main problems was lack of contract compliance, especially with respect to safety and lack of CQC enforcing contract requirements. For example, the following summary shows the magnitude

of some of the problem areas as documented on the construction daily logs:

Subject	No. of Different Days on Which the Incidence Was Documented
1. Improper or no scarification of previous lift	101
2. Government temporarily stopped/halted some of contractor's equipment (while active) due to safety violation	60
3. Roller passes shorted or otherwise deficiently performed	54
4. Fill lift too thick	127
5. Roots/organics in fill	39
6. Safety: Construction equipment operated too close to pedestrians	11
7. Safety: Dusty haul roads	203
8. Safety: Haul road too narrow	66
9. Safety: Flagperson needed	32
10. Safety: Back-up alarm violation	175
11. Safety: Operator on large equipment more than 10 hours	21
12. Safety: Inadequate brakes on large equipment	42
13 Safety: Large equipment being driven too fast	77
14. Safety: Unattended large equipment with engines running	77
15 Accident: Large equipment crash/overturned	21
16. Safety. Seat belt violation	41
17 Safety: Hard hat violation (not worn)	130
18. Safety: Improper or inadequate clothes	35

In addition to the above type problems, throughout the job there was great reluctance on the contractor's part concerning his reworking areas failing to meet contract requirements. The contractor's point of view was that a passing test represented a large volume of fill and that a failing test required him to only rework an area the width of a dozer blade by about 30 feet in length. To contend with this, the Government chose retest locations that may or may not have been located where the original test failure occurred. The actual volume of rework performed on the job is estimated at less than one percent of the total volume.

7-08. Construction Modifications.

a. Initial Contract. - During the initial contract, the following modifications were implemented.

Mod No.	Description	Approximate Amount ($)
P00001	Relocate fence at archaeological site west of outlet works	180
P00002	Delete note on Sequence No. 4 for optional use of house and buildings by contractor; provide barbed wire fence around old house and building	22,000
P00003	Allow topsoil stockpiling upstream of the left embankment (credit)	-3,650
P00004	Revise low flow intake and other miscellaneous items in the Outlet Works-Intake Structure; and delate the stilling basin stop logs and lifting beams (credit)	-24,827
P00005	Construct Government office complex using an existing trailer and a new contractor furnished trailer	22,927
P00006	Expand the liquid limit (LL) range of compacted impervious backfill used for the outlet works to be equal to or greater than 40 and less than or equal to 70	0
P00007	Revision of specifications for select impervious fill to having: $30 \leq LL \leq 45$ within 75 feet of the spillway centerline, and $30 \leq LL \leq 60$ for all other areas	0

Mod No.	Description	Approximate Amount ($)
P00008	Provide aerospray 52 and 1-1/2-inch thick protective concrete in lieu of pneumatic concrete in the excavation for conduit joint footings (credit)	-3,517
P00009	Revise arrangement of low flow gate hoists and shear connectors to roof double tees	635
P00010	Install embedded material for stop log slot in stilling basin monolith No. 6 of the outlet works intake structure. Also, revision of a portion of P00004.	14,672
P00011	Revise concrete finish in a portion of the Outlet Works-Intake Structure	810
P00012	Revise Special Provision 23 by deleting "DD Form 1140-1" and substituting "Standard Form 295"	0
P00013	Provided 9 additional days due to weather	0
P00014	Provided 26 additional days due to weather	0
P00015	Provided 7 additional days due to weather	0
P00016	Provided 15 additional days due to weather	0
P00017	Delete installation of letters on Outlet Works Tower (credit)	-750
P00018	Provided 12 additional days due to weather	0
P00019	Procurement of additional supplies for QA testing	9,967
P00020	Repair of floodplain slope erosion	8,500
P00021	Provided 1 additional day due to weather	0
P00022	Payment of interest on monies due the contractor concerning clearing and grubbing	1,429
P00023	Repairs associated with service gates and an increase of 18 days in the contract	60,278
P00024	Stripping and exploration of a borrow source for materials to construct the spillway embankment	35,000
P00025	Non-shrink grout for anchor bars, and extended contract by 52 days	13,365

b. Completion Contract. - During the completion contract, the following modifications were implemented.

Mod No.	Description	Approximate Amount ($)
P00001	Time of performance extended 215 days for delay in issuing notice to proceed from 15 Oct 81 through 18 May 82	0
P00002	Furnish 2 trailers for Government offices	99,595
P00003	Revision of centerline profile of the deep inspection trench approximately between stations 10+50 and 8+10	27,074
P00004	Provide electrical services	83,500
P00005	Revision of finish grade of spillway slabs monoliths No. 4 through No. 13	2,104
P00006	Compensation for delay in issuing notice to proceed	449,995
P00007	Traffic control and barricades to close Belt Line Road	6,481
P00008	Interest on Modification P00006	40,711
P00009	Additional excavation of unsuitable material	220,000
P00010	Revision of spillway expansion joint (credit)	-350
P00011	Provision for grouted riprap in the areas of the outlet works access to fishing platform	2,320
P00012	Provision and installation of project name on the Outlet Works Tower	12,000
P00013	Provided 72 additional days due to weather	0
P00014	Administrative change (increase in funds available)	N/A
P00015	Revision of spillway finish from Class B to Class D and furnish water well (credit)	-10,000

7-09. Construction Photographs. - Selected photographs taken during and subsequent to the main contracts are presented on exhibits 1 through 11

SECTION VIII - EMBANKMENT FILL QUALITY ASSURANCE

8-01. General. - Embankment fill construction was controlled and monitored through a Contractor Quality Control (CQC) system and a Government Quality Assurance (GQA) system, respectively. Only the latter will be discussed herein. The GQA system included an acceptance sampling and testing program and visual observations by inspectors. Sampling and testing were accomplished using frequencies deemed necessary by the Contracting Officer. Quality assurance samples were selected from lifts-below-compacted lifts; i.e., samples were not taken until the materials were covered by a minimum of one lift of compacted fill. The specifications indicated that the GQA Program could consist of each sample being tested for classification, moisture content, liquid limit and bar linear shrinkage In addition to the above, approximately every fifth sample could have included in-place density and plastic limit tests. On approximately every tenth sample, a Standard compaction test could be run in addition to the tests outlined for every fifth sample. During construction, unacceptable material or unacceptable in-place moisture contents resulted in either reworking, removal, or retesting of the material in question. Since in-place density was not specified for the rolled fill, materials were never rejected because of density. Experience on this and previous projects in similar materials has proved that at least a 95 percent Standard density is obtained provided the lift thickness, moisture content, and compactive effort are in accordance with the specifications These provisions, when combined with the controls afforded by the Liquid Limit Correlation Method, form a superior fill placement quality assurance program in these type materials.

8-02. Fill Properties - On a monthly basis, data from the GQA laboratory tests on the impervious, select impervious, random and semi-compacted zones were summarized on ENG Form 4080. A plasticity chart for materials from the borrow areas is shown on plate 68. The following tabulations provide summaries of some of the pertinent engineering data.

a. Initial Contract (All Values Are Approximate)

Fill Zone	Average LL	Average PI	Average W	Average $W-W_o$	Average % Compaction
Impervious (Outlet Works)	60	38	23.2	+2.0	100
Impervious (Embankment)	72	49	25.9	+1.9	102
Select Impervious (Under Spillway)	43	28	18.7	+1.5	106
Select Impervious (Embankment)	52	34	20.7	+1.4	105
Random	71	50	25.5	+1.7	103
Semi-Compacted	66	43	24.1	+1.0	104

LL - Liquid Limit
PI - Plasticity Index
W - Field Water Content
W_o - Optimum Water Content

b. Completion Contract (All Values Are Approximate)

Fill Zone	Average LL	Average PI	Average W	Average $W-W_o$	Average % Compaction
Impervious	67	46	25.6	+1 6	104
Select Impervious	52	36	21.4	+1.5	105
Random	67	46	25.3	+1 1	105
Semi-Compacted	69	47	25.2	+0 6	106

8-03. Liquid Limit Correlation Method. - Acceptance of fill moisture was accomplished using the Liquid Limit Correlation Method. This method has been utilized successfully on numerous embankments within CESWF. Embankment and borrow samples are used to establish correlation curves that represent the relationships between liquid limit and optimum moisture, and liquid limit and maximum dry density. Thus, a liquid limit value obtained from an embankment sample during construction is used in conjunction with the correlation curves to determine the maximum dry density and the optimum moisture content for that sample. These values are then compared with the in-place moisture and/or density to determine compliance with specified moisture requirements and to verify desired compaction.

a. Establishment of Correlation Curves. - Tests were initially performed on materials representing the range of materials expected from the borrow areas and from required excavations using materials obtained from borings. These data were used to establish the so-called "starting" curves for the initial contract. The data obtained during the initial contract were used to establish the "starting" curves for the completion contract

b. Updated Correlation Curves. - During the construction, the Government continued to conduct compaction and other tests to evaluate the current curves and to make appropriate update changes or extensions to them. The correlation curves utilized on both construction contracts are presented on plates 66 and 67.

c. Use of Correlation Curves. - The relationship of field moisture content to specified values was determined in the Government's on-site laboratory for each embankment sample. Sand cone densities and Standard compaction tests were performed less frequently. A complete summary for the completion contract (Government Quality Assurance Tests) is as follows:

GQA Test Types	Test Frequency (Test/Cubic Yards) (Completion Contract) Req'd By Contract	COE Manual*	Imp. Fill	Random Fill	Semi-Compacted Fill	Combined All
Moisture Content & Liquid Limit (MC & LL)	As Deemed Necessary By Gov't	Not Stated	1/470	1/1080	1/3480	1/940
Field Density (in addition to MC & LL)	Approx 1/5 the freq. of MC & ML	1/1000 to 1/3000	1/2600	1/6040	1/29,050	1/5280
Standard Compaction (in addition to field density, MC & LL)	Approx 1/10 the freq. of MC & LL	Not Stated	1/7400	1/18,740	1/58,680	1/15,420

*EM1110-2-1911

As indicated in the tabulation, the frequency of testing was greater in the more important central zone and lesser toward the outer zones. The methodology was such that the laboratory personnel would run liquid limit and moisture content tests on control samples and then compare the optimum moisture obtained from the correlation curve to the sample moisture content. The specifications allowed the following range of in-place moisture contents:

Fill Zone	Allowed Moisture Content Range From Optimum, %
Impervious	0 to +3
Select Impervious	0 to +3
Random	-2 to +3
Semi-Compacted	-2 to +3 (initial contract) -5 to +4 (completion contract)

The contractors were always allowed a deviation of at least 0 4% outside the specified ranges. Field density, obtained by sand cone, was compared with the maximum laboratory density obtained from the correlation curve of liquid limit versus 100 percent of maximum Standard compaction density. The target or desired minimum density was equal to or greater than 95 percent of maximum laboratory density, although no minimum was specified. The usual range of achieved values was from 95 to 120 percent compaction. This range for percent compaction is also typical for other CESWF embankments involving CL and CH materials.

d. Accuracy of the Method. - The liquid limit correlation method is well suited for use on CL and CH clays. This fact makes it ideal for use in most areas of CESWF. Due to the contractor's contention in a claim that the method was inaccurate, an extensive study was undertaken to show otherwise. Since nearly 600 Standard compaction tests had been performed during the completion contract in conjunction with the liquid limit test, a "what if" type comparison was easy to perform concerning acceptance of in-place moisture content. The following is a summary of the comparison expressed as percentages of the total tests in each zone on which the compaction test was performed.

	Based on LL		If Standard Compaction Test Had Been Used			
Fill Zone	% Pass	% Fail	% Pass	% Fail	% Pass But Failed by LL	% Fail But Passed by LL
Impervious	80-83	17-20	60-62	38-40	3-4.5	23-25
Random	88-89	11-12	73-76	24-27	1-3	13-19
Semi-Compacted	95-97	3-5	93-97	3-7	2.5-3	3-5
Select Impervious	81-82	18-19	64-73	27-36	5-5.5	13-22

Stated differently, the results of the "what if" comparison as to acceptable in-place moisture content shows the following.

Both methods agree (Both pass or both fail)	75% - 80% of cases
Compaction test would have given a failure when LL method did not	17% - 21% of cases
LL method gave a failure when compaction test would not	3% - 4% of cases

Based on this comparison, the liquid limit correlation method did not adversely affect the contractors; and in fact, according to these data, it appears to have been "easier" on them than waiting and using the Standard compaction tests results in that moisture content failure rates would have been higher. The U.S. Claims Court agreed with the above.

8-04. Moisture Content Failure Rate. - Final acceptance or rejection of in-place fill based on its moisture content was accomplished using the liquid limit correlation method as described above. Government Quality Assurance testing was performed at locations previously selected by designers and at locations selected by the construction personnel based on their judgment. Based on the results of this testing on initial tests (i.e., not considering retesting of failed areas), the percent of tests failing to meet specified moisture content ranges understandably varied as a function of the magnitude of allowed moisture range or "window". This variation can be seen numerically for the completion contract in the tabulations in paragraph 8-03, and graphically for both contracts on Plate 69. By comparison to other dams in CESWF which involved high plasticity clays, it can be seen that the test failure rate on the Joe Pool project was not unusual. This comparison is presented on Plate 70. Failing tests were reported to the contractors for them to rework each area

8-05. Construction Inspection By Geotechnical Personnel. - Foundation preparation and fill construction were inspected and evaluated by geotechnical engineers throughout both the initial and completion contracts. All foundation approval was performed by a geotechnical engineer, and all excavations and inspection trenches were mapped and approved by a project geologist.

SECTION IX - RECORD SAMPLES

9-01. General. - A total of 42 record samples were obtained during both of the construction contracts. The purpose of these record samples was to obtain data to compare to the assumed design parameters and to provide documentation of as-built conditions. These samples were taken from the impervious, select impervious, and random zones of the embankment Record samples were not taken from the semi-compacted fill zones. Record samples were obtained at depths of greater than 2.5 feet below the then current fill elevation to ensure that they would represent materials to be left in-place

9-02. Sampling and Testing. - At each record sample location, both undisturbed and disturbed samples were obtained. The undisturbed sampling consisted of pushing a 7.5-inch diameter by 10-inch high steel sampler into the compacted fill by jacking against a dozer blade, trimming around it, followed by removal and sealing the ends. The disturbed (bag) samples consisted of about 150 pounds of fill and were obtained from the material surrounding the undisturbed samples. The samples were transported to the CESWD Laboratory in Dallas, Texas, for testing. The record sample testing was not always very timely; i.e., up to a year passed before testing some samples actually occurred as shown on plate 79. The effect of this long sample storage time on strength is not known. The record samples were subjected to the following laboratory tests: visual classification, grain size analysis (mechanical and hydrometer), Atterberg limits, bar linear shrinkage, specific gravity, expansion consolidation, Standard compaction, direct shear (S), unconsolidated undrained (Q), and consolidated undrained (R) tests.

9-03. Laboratory Test Results and Evaluation. - The record sample test summary shown on plate 79 indicates the zone, location, and some of the engineering parameters other than shear strengths determined from record samples. The table also indicates that of the 42 record samples, 22 tests were in the impervious zone, 5 tests were in the select impervious zone, and 15 tests were in the random zone For comparison to design values, the shear strengths from record samples as determined by Q, R, and direct shear (S) tests have been plotted for each contract as shown on plates 71 through 78 These plots show that the as-built Q and R strengths are at or above design assumptions and that the S strengths are at or slightly below. These slight variations from design assumptions can be attributed to the fact that the average liquid limits of the materials actually utilized by the contractors was higher than assumed during design. The use of these higher plasticity materials will result in higher shrink-swell capacity and the potential for shallow surface sloughs and/or down-slope creep. This is a common maintenance problem for embankments in this area of the country. These problems are usually first evident as cracking at the crest edges. Slides are usually initiated as water enters cracks and lubricates these shallow failure planes On Joe Pool, an experimental downstream concrete edge cover was constructed along a major length of the embankment to serve as a surface water shed This is the second embankment in SWF where this technique is being studied.

SECTION X - EMBANKMENT AND FOUNDATION INSTRUMENTATION

10-01. General - For purposes of performance evaluation and construction monitoring, the following instruments were installed: piezometers, settlement plates, embankment station monuments, outlet works reference pins, spillway reference marks, deep bench marks and heave points. Plans of instrumentation locations are presented on plates 98 through 100. These devices were installed and monitored by the contractors and the Government in accordance with the schedules as outlined on plates 80 through 81. In addition, these plates provide information on location and design of the various types of instruments.

10-02. Piezometers.

a. General. - There were a total of 18 porous plastic tip piezometers installed by Government forces during construction of this project Plates 80, 81 and 98 through 100 provide information on the location, filter elevation, and design of the piezometers. This type of piezometer has been used on numerous projects throughout CESWF and has proven to function well in a variety of materials including clay shales, granular and high plasticity clay materials The piezometers were installed to monitor any excess pore pressures developed in response to fill placement, and any seepage pressures after impoundment. Excess pore pressure in this report is defined as the ratio of increased piezometric pressure above natural ground to the increased foundation pressure due to fill at that location, expressed as a percentage Piezometers were installed along four sections in the floodplain and at the spillway Readings of these instruments were taken by the contractors on a weekly basis, while the Government verified the readings at random. Since completion, the piezometers have been read on a quarterly basis. All other instrumentation is being read annually Pool elevation vs time is presented on plate 82 Analyses of the piezometer readings are presented in the following paragraphs.

b. Station 16+00± - The initial plans for this station called for the installation of three piezometers in a supposed pervious buried stream channel. Investigations during the construction of the embankment and the installation of P-10 and P-12 failed to show any indications of a pervious channel. Therefore, P-11 was not installed. Plots of piezometric elevation, fill placement and lake elevation versus time are shown for P-10 and P-12 on plate 86. Piezometer P-10 is located in a sandy clay layer of the overburden and showed no readings until a few months after completion of fill placement. P-10 readings remained at approximately 1 foot above the tip until 1988. Since then it has been dry. Piezometer P-12, which is located in weathered clay shale, responded immediately to fill placement with a maximum excess pore pressure response of less than 10 percent. Its readings steadily declined until a slight increase in 1989 to slightly above the level recorded in 1983.

c. Station 38+50± - At this section, five piezometers were installed, two in unweathered clay shale and three in overburden materials. Piezometers P-1 and P-3 were placed in the unweathered clay shale and have shown the responses as shown on plate 83. P-1 reacted immediately to fill placement and reached a maximum excess pore pressure of less than 60 percent Since the completion of fill placement, P-1 has shown a steady decrease in pressure and without any response to pool Piezometer P-3 has shown a slow, but steady increase in pore pressure, but of insignificant magnitude. Piezometers P-2, P-4A, and P-13 were installed in the overburden clays and provided the data as shown on plate 87. P-2 showed an excess pore pressure response of less than about 10 percent which has since been decreasing. A falling head test and subsequent readings have shown that P-2 is obstructed at El. 463± and may no longer be functioning properly. Piezometer P-4A was installed to replace P-4 which was damaged during construction. P-4A has shown no response to either fill placement or pool. Piezometer P-13 reacted several months after completion of fill placement and showed an increasing level until its submergence. However, using the definition herein, it did not exhibit any excess pore pressure.

d. Station 50+00± - Three piezometers (P-14, P-15 and P-16) were installed in a gravelly-sandy clay at this section of the embankment. Readings are shown on plate 88. Piezometer P-14, which is located downstream, has shown essentially no change in readings. P-15 is located near the embankment centerline and responded rapidly to fill placement with an excess pore pressure of less than 25 percent. Pore pressure then dissipated until impoundment. Since then, P-15 readings have reflected changing pool levels P-16 was abandoned due to submergence. It showed no excess pore pressure response during fill placement.

e. Station 63+00± - Piezometers P-17, P-18, and P-19 were installed in overburden clays at this section of the embankment. Readings are shown on plate 89. Piezometer P-17 has remained dry, while P-18 and P-19 responded minimally to fill placement. None have shown any response to pool changes. Piezometer P-19 has been submerged.

f. Spillway - Station 100+00± - Five piezometers were installed in the vicinity of the spillway with readings as shown on plates 84 and 85. Piezometers P-6, P-8, and P-9 are located in weathered clay shale, and P-5 and P-7 are located in clay overburden. All five of these piezometers have remained relatively dry or have shown very slight response to pool changes.

g. Analysis of Piezometric Data. - With the exception of piezometer P-

15, all of the piezometers have shown no substantial response to pool changes. All the floodplain piezometers within the limits of the embankment displayed an increased piezometric surface due to fill placement. Several of the floodplain piezometers have shown what appears to be either a very minimal horizontal translation of pore pressure related to the construction of the embankment or a response to pool. In the area of the spillway, there has been essentially no increases in piezometric elevations due to the reservoir pool elevation nor due to the fill load. The maximum excess foundation pore pressure profile actually experienced during construction was less severe than assumed during design.

10-03. Settlement Plates.

a. General. - During the initial contract, there were a total of six settlement plates installed - two in the floodplain and four at the spillway. The three settlement plates located at the embankment-foundation contact were installed by the Contractor. The remaining three required drilling and were installed by the Government. These deeper plates are designated with "D" prefixes for "deep". All settlement plates were maintained and read by the Contractors on approximately a weekly basis. Plate 81 shows the details for both types of instruments, while plates 98 and 99 show their locations. Since completion of this project, the Government has been conducting annual surveys

b. Floodplain - Station 38+50± - There were two settlement plates installed at this location of which DSP-1 was placed on top of the weak overburden clay layer at El. 444±, while SP-1 was placed at the embankment-foundation contact. Plate 90 indicates there has been slightly over 2 0 feet of total settlement occurring in the foundation materials as recorded by SP-1 Based on DSP-1, the upper 29± feet of overburden has accounted for about 1 0 foot of this total and an equal amount has occurred in the remaining overburden (12± feet) and primary materials. Rate of settlement has been decreasing and is approaching 0.05 foot per year. Most of this remaining settlement is occurring in the primary materials.

c. Spillway - Station 100+00±. - Four settlement plates were installed to monitor the spillway foundation. One shallow and one deep settlement plate was placed on each side of the spillway. For purposes of discussion, the spillway can be divided into left side settlement plates (station 100+50±) and right side settlement plates (station 99+50±) as shown on details No. 1 and 2 on plates 91 and 92. These instruments were installed to evaluate the success of preloading the foundation by monitoring settlement and/or heave prior to and after the construction of the spillway. The right side instruments consist of SP-2 and DSP-2 which were placed at the embankment-foundation contact and on top of weathered clay shale, respectively. Plots of the settlement plate movements for SP-2 and DSP-2 are shown on plate 91. The left side consists of SP-3 located at the embankment-foundation contact and DSP-3 located on top of unweathered clay shale. A plot of the movements associated with SP-3 and DSP-3 is presented on plate 92. During the preloading stage, the right side (east) underwent a total settlement of about 0.4 foot, while the left side showed about 0.3 foot. Both sides showed about a 0.1-foot rebound or heave at the foundation contact in response to excavation for constructing the spillway. Subsequent to spillway construction and fill placement, both sides of the spillway have approached the same total settlement value of 0.3 foot. About one half of this total occurred in the overburden materials and one half in the primary materials. The rates of settlement have now essentially approached zero.

d. Analysis of Settlement Data. - The settlement plate surveys indicate settlement magnitudes that are within expected ranges. The preloading of the spillway foundation can be considered a success in that differential settlements were essentially avoided, and total settlement occurring after the reloading has been about 0.1 foot.

10-04. Embankment Station Monuments.

a. General. - Embankment station monuments were installed at every whole numbered station from station 3+00 to station 219+00. Plate 81 shows the typical detail for these monuments that were placed on the downstream portion of the crest along the guard rail. Surveys have been conducted to coincide with periodic inspections.

b. Analysis of Crest Movements. - Plate 93 shows the comparison of the initial survey to the latest survey. This amount of settlement reflected corresponds to the amount also recorded by the settlement plates. Thus, the consolidation reflected by the crest surveys is accountable for as foundation settlement rather than within the embankment itself. The greatest amount of settlement recorded has understandably been recorded in the closure section (station 41 to 63).

10-05. Outlet Works Reference Pins.

a. General. - Reference pins were installed during the initial contract along the invert of the outlet works intake tower and conduit, along the discharge chute, and on the stilling basin walls A typical detail of these pins is shown on plate 81 These pins have been read a total of four time since July 1985, not including the initial survey which was conducted in September 1984. This initial survey was used as a base line with all movements being referenced to this line

b. Analysis of Outlet Works Reference Pin Data. - Plate 94 shows a plot of the surveys along the invert of the tower and conduit. These surveys indicate essentially no changes in any of the referenced locations. Most of these apparent differential movements (less than 0.1 foot) can be assumed to be related to survey inaccuracy rather than conduit settlement. To date no surveys have been conducted on the pins in the discharge chute; however, steps are being taken to verify that they do exist and to begin taking readings. Plates 96 and 97 provide a tabulation of the horizontal and vertical measurements on the outlet works stilling basin wall pins. These data indicate that the stilling basin has undergone practically no movement.

10-06. Spillway Reference Marks.

a. General. - During the completion contract, 18 reference marks were installed in the walls and slab of the spillway. The contract required 20 reference pins as shown on plate 81. The Contractor did not etch reference point numbers 4A and 6A on the metal expansion joint until several months after the completion of the roadway. These points were first surveyed in 1985. The detail for these marks is similar to the outlet works reference pins

b Analysis of Reference Mark Data. - A table of the survey data for the spillway reference marks is presented on plate 96. The data indicate no substantial movements to date. This, combined with the settlement plate data discussed earlier, indicates that the foundation preloading during the first contract was successful.

10-07. Deep Bench Marks. - A total of six deep bench marks were installed These bench marks, which are identical in design to the deep settlement plates as shown on plate 81, were installed to provide a stable reference datum for elevation surveys during and after construction of the dam. All of these bench marks are founded in clay shale at the locations and depths as tabulated on plate 33.

10-08. Heave Points. - Prior to spillway excavation, 12 heave points were installed in drilled holes in the area of the spillway discharge chute and stilling basin. Plate 98 presents a tabulation of the locations of these points with reference to the spillway centerline. The data from these points were either inconclusive/inaccurate or indicated there were insignificant movements; therefore, the data are not presented This type of instrument is not recommended for future application due to the problems associated with installing them in small diameter holes and accurately taking initial readings.

SECTION XI - DOWNSTREAM EMBANKMENT SLIDE

11-01. General. - In late 1988, cracking was observed from station 89 to 93 along the downstream edge of the embankment crest. Progressive movement was observed for about 5 months until a relatively large downstream slope failure occurred on 1 January 1989 Movement continued and by 22 March 1989, the slide extended about 600 feet along the crest (sta. 88+50 to 94+50) and, for a shorter reach, had retrograded to the upstream edge of the crest. A near vertical scarp about 18 feet high had developed and the failure involved about 50,000 cubic yards of material.

11 02. Subsurface Investigations - Borings and backhoe trenches were dug through the embankment materials to investigate the nature of the slide. A soft, very wet, continuous layer of embankment materials (3 to 4 inches thick) was discovered at or about elevation 528.5, or approximately 3 feet above natural ground. Laboratory testing showed the materials to be 7 to 10 percent

above optimum moisture content. No evidence of similar wet material was observed in fill above or below this layer, nor outside the slide limits or within the foundation.

11-03. Cause of Slide. - The cause of the slide was a soft, very wet layer of fill surmised to be the result of a construction deficiency. The layer, which was located about 3 feet above natural ground, was probably a rain-soaked layer that was bridged-over rather than being reworked to proper moisture content. This deficiency is also evident by reviewing construction records in that a 1-inch crack along the crest from station 87+00 to 90+00 was observed by an inspector at the time when the embankment was being topped-out. Documenting the crack and then allowing the crack to be plowed and filled over, effectively temporarily masking the movement evidence, was unfortunately the only action taken. It is believed that the crack was the first sign of the beginning of a progressive failure through the wet layer, ending as the materials approached steady-state strength conditions.

11-04. Repair. - A construction contract was developed to repair the slide area using accelerated contracting procedures The repair consisted of removal and replacement of most of the slide materials from station 89+00 to 94+00 and then flattening the downstream slope to 1V on 4.5H from station 84+00 to 99+00 (plates 101 through 104). The overall cost for design and construction for the contract was approximately $1,070,000.

SECTION XII - INSERVICE EVALUATION

12-01. General. - The inservice performance of the Joe Pool embankment and appurtenant structures foundation has shown to be good. Deliberate impoundment began on 7 Jan 86 Conservation pool elevation 522 was first attained in May 1989. The embankment and appurtenant structures has already been subjected to five periodic inspections as part of the program for Continued Evaluation of Completed Civil Works Projects. Instrumentation is being read and evaluated on a scheduled basis. In addition to the periodic inspection program, surveillance inspections have been conducted subsequent to deliberate impoundment in accordance with the "Reservoir Filling Plan," DM No. 29. All data and observations indicate the embankment is and will continue to function as a safe structure.

SECTION XIII - CLAIM AND LITIGATION

13-01. General. - The following summary was written by William Brown (CESWF-OC). Additional information concerning the litigation and lessons learned can be obtained by calling him at 817-334-3561.

13-02. During the completion contract, the contractor presented a claim to the Government for $13,146,740, alleging several causes of action The primary basis for the claim was an alleged differing site condition involving the fill materials to be used in the embankment. The contractor alleged both type I and type II differing site conditions. It alleged that the contract documents materially misrepresented the nature of the fill materials to be used in the embankment, a type I condition. It also alleged that the fill materials were unusual and differed materially from those generally used in construction projects of this type, a type II condition

a The contractor also alleged that the specifications were defective, primarily that the liquid limit correlation curve was a defective method of determining acceptability of the compacted fill materials. The contractor also alleged that its costs were increased by the Government's over-testing of the embankment materials; by selective testing of non-representative materials, that is, small areas of materials that were either too wet or too dry and which did not accurately represent the area from which the sample was taken; and that the Government improperly interfered with its operations with over-zealous inspections an general harassment and uncooperativeness on the part of the Government field personnel.

b. The claim was appealed to the U.S. Claims Court, and at the time of the trial in March 1988, the amount of the claim had been revised to $41,877,029. An extensive hearing was held during which 6 weeks of testimony was presented by the contractor and the Government

13-03. The Claims Court issued its decision in February 1989 Most portions of the contractor's claim were denied, including the type I differing site condition and the allegations of over-testing, defective test methods, non-representative testing, and harassment and interference on the part of the Government personnel. Of particular note was the fact that the court found that the data in the contract documents concerning the fill material were accurate and did not misrepresent the nature of the fill material to be used in the embankment However, the court did find that the contractor had encountered a type II differing site condition in that the fill materials, in their extreme toughness and difficulty to work, were unusual in nature and differed materially from those normally encountered in construction work of this nature. From a design standpoint, the court's decision did not fault the project's designers; it said essentially that no amount of information in the contract documents could have adequately warned a prospective contractor of the extreme toughness of the material, which it found to be some of the toughest material in the world. While a geotechnical engineer could possibly have predicted the relative toughness of the fill materials by analysis of the index properties of the materials utilizing a plasticity chart, the court found that a prospective construction contractor could not have predicted the difficulty of working these materials from the information presented in the contract or, in fact, any other objective data.

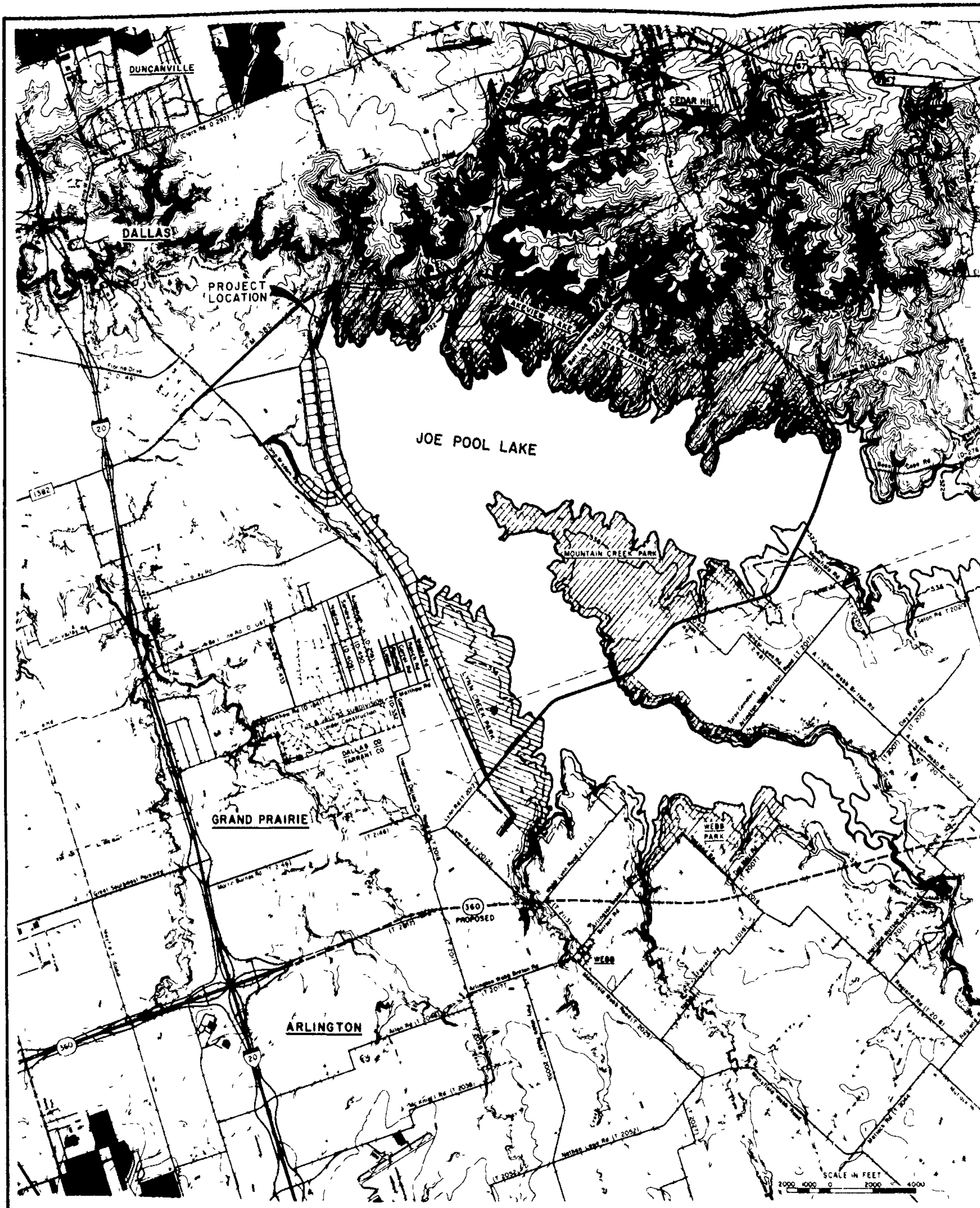
13-04. The court awarded damages in the amount of $14,703,211.43, plus interest pursuant to the Contract Disputes Act of 1978. The damages were awarded on a total cost basis; i.e., the difference between the contractor's bid price and the total costs the contractor incurred on the project. The court, however, modified the recovery based on the fact that it found that the contractor's bid was unreasonably low, partially the result of a poor pre-bid site investigation. To account for this fact, the court substituted the bid of a different bidder on the project for the amount the contractor should have bid. That bid was found to have been reasonable based on testimony concerning the bidder's experience in working with soils in Texas and in the vicinity of the project That bid, then, formed the baseline for the determination of the contractor's increased costs, which the court attributed in full to the type II differing site condition The contractor presented convincing evidence through its auditor that it had incurred substantially increased costs on the project, and the court relied entirely on the contractor's cost data The Government was unable to disprove the contractor's data, and the court found that the Government's DCAA audit of the claim and the auditor's testimony at the hearing were unpersuasive and lacked coherence.

13-05. Since the decision indicated that the contract documents could not have been improved to indicate the nature of the fill materials, the primary lessons to be learned from the claim and litigation are in the area of damages Because the contractor's recovery was based on the total cost method, the Government needed to show that the contractor's increased costs were not totally related to the differing site condition and that all, or at least most, of the increased costs resulted from the contractor's inefficient construction methods and its inexperience in dealing with material of this type. Two major lessons can be learned from the Government's experience in this litigation.

a. First, it is absolutely essential that the Government accurately and completely document any difficulties a contractor may be having during construction, especially if they are related to a possible claim dealing with differing site conditions. The Government, in this litigation, was unable to convincingly prove to the Claims Court that the contractor increased its own construction costs because of its inefficiency, poor construction methods, and lack of effective quality control. It is essential that detailed documentary evidence of such failures on the part of the contractor be kept throughout the project in order to support testimony at a hearing. Especially helpful in the case of this litigation would have been videotape of the contractor's construction methods and illustrations of how its lack of quality control contributed to the increase in its costs

b. Second, the Government needs to get any necessary expert witnesses involved as early in the process as possible. Even though the contractor's claim on this project was filed in February 1984, the Government did not hire the expert witness it used at the trial until approximately June 1986. By that time, construction of the embankment had been completed, and the expert witness was not able to observe the contractor's operations on the embankment While a test pit in one of the borrow areas was dug to allow the expert to observe the materials, this did not effectively substitute for observation of the contractor's actual construction methods and any difficulties the contractor had with the fill material. As such, the Government was at a disadvantage with the contractor, whose expert had observed the embankment work in progress in 1985.

13-06. This case was somewhat unusual in that the claim was filed when the project was still underway; in fact, over one-half of the embankment volume remained to be placed at the time the claim was filed Thus, the Government had ample opportunity to hire an expert and have that expert observe the actual embankment construction. To ensure that an expert witness has the opportunity to observe the actual conditions, it is recommended that on future large projects, consideration be given to hiring an expert even before a claim is filed. This should be done if there is sufficient indication through the contractor's correspondence or verbal communication that a claim may be filed. By so doing, the Government will ensure that its expert is sufficiently prepared to testify even if the contractor waits until the job is completed or nearly completed to actually file claims If claims are not filed, the expense would still be justified when compared to the Government's potential risk of damages.


DUNCANVILLE
CEDAR HILL
DALLAS
PROJECT LOCATION
JOE POOL LAKE
MOUNTAIN CREEK PARK
STATE PARK
LYNN CREEK PARK
WEBB PARK
GRAND PRAIRIE
DALLAS CO
TARRANT CO
ARLINGTON
WEBB
PROPOSED
360
20
1382
SCALE IN FEET
2000 1000 0 2000 4000

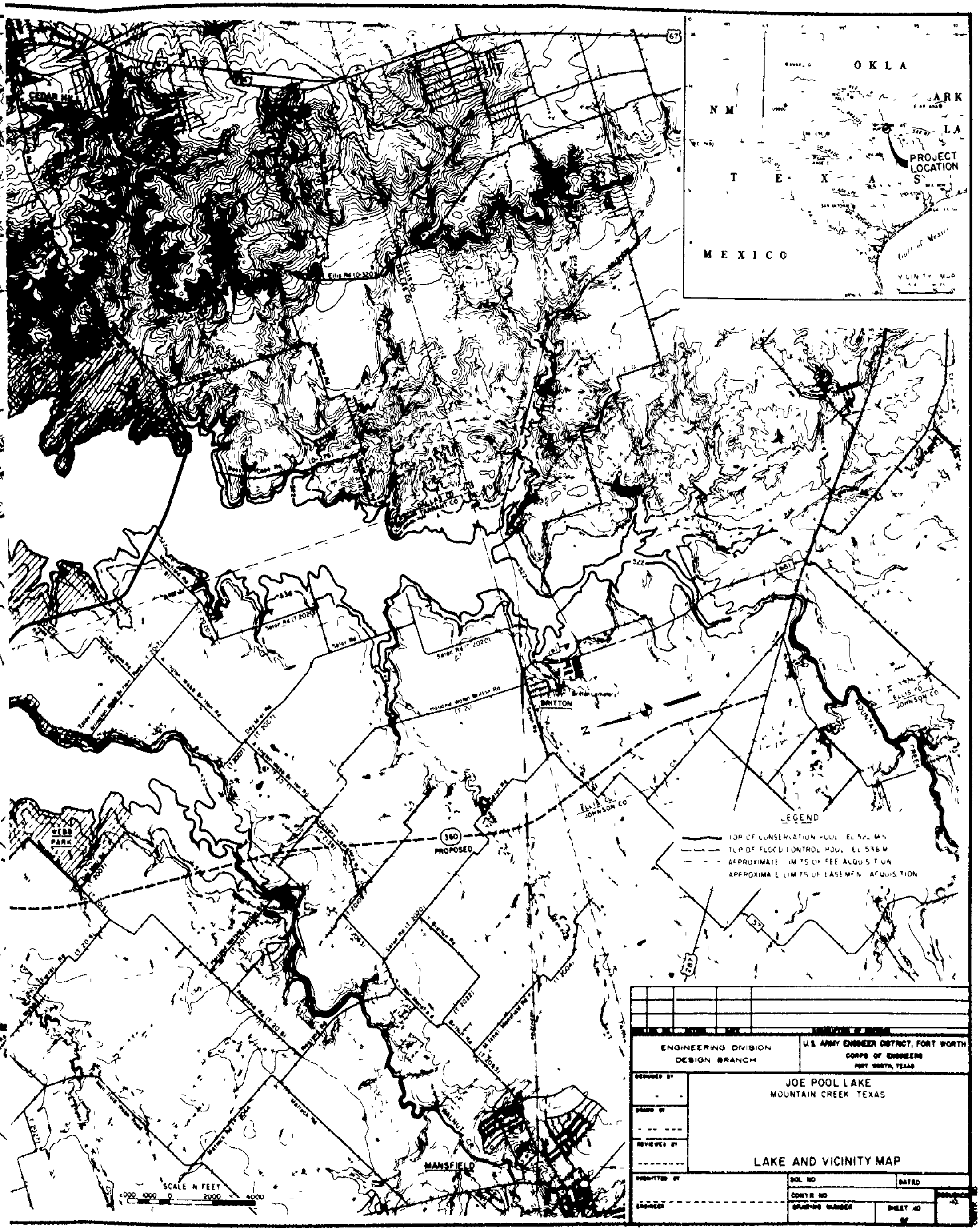
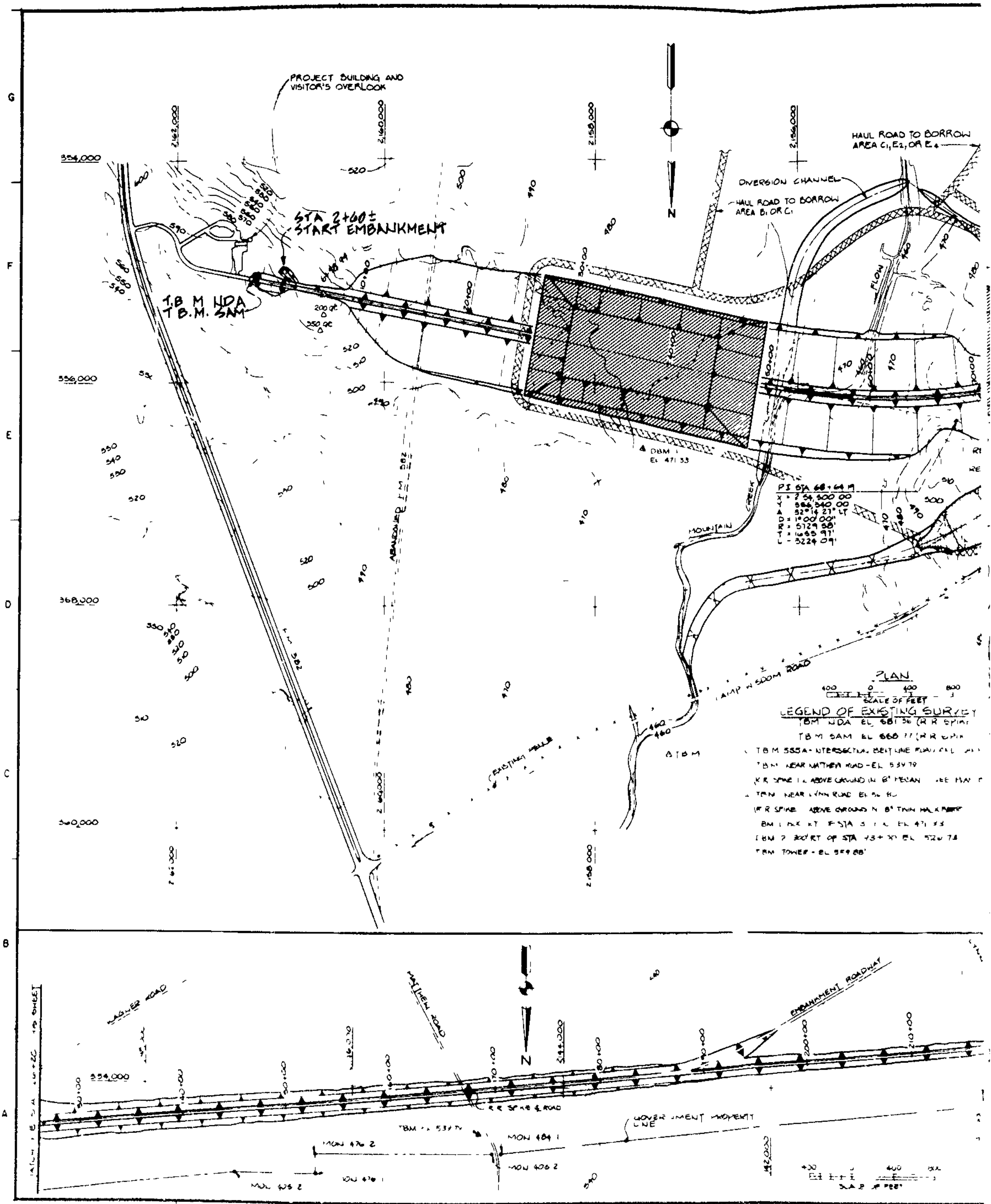
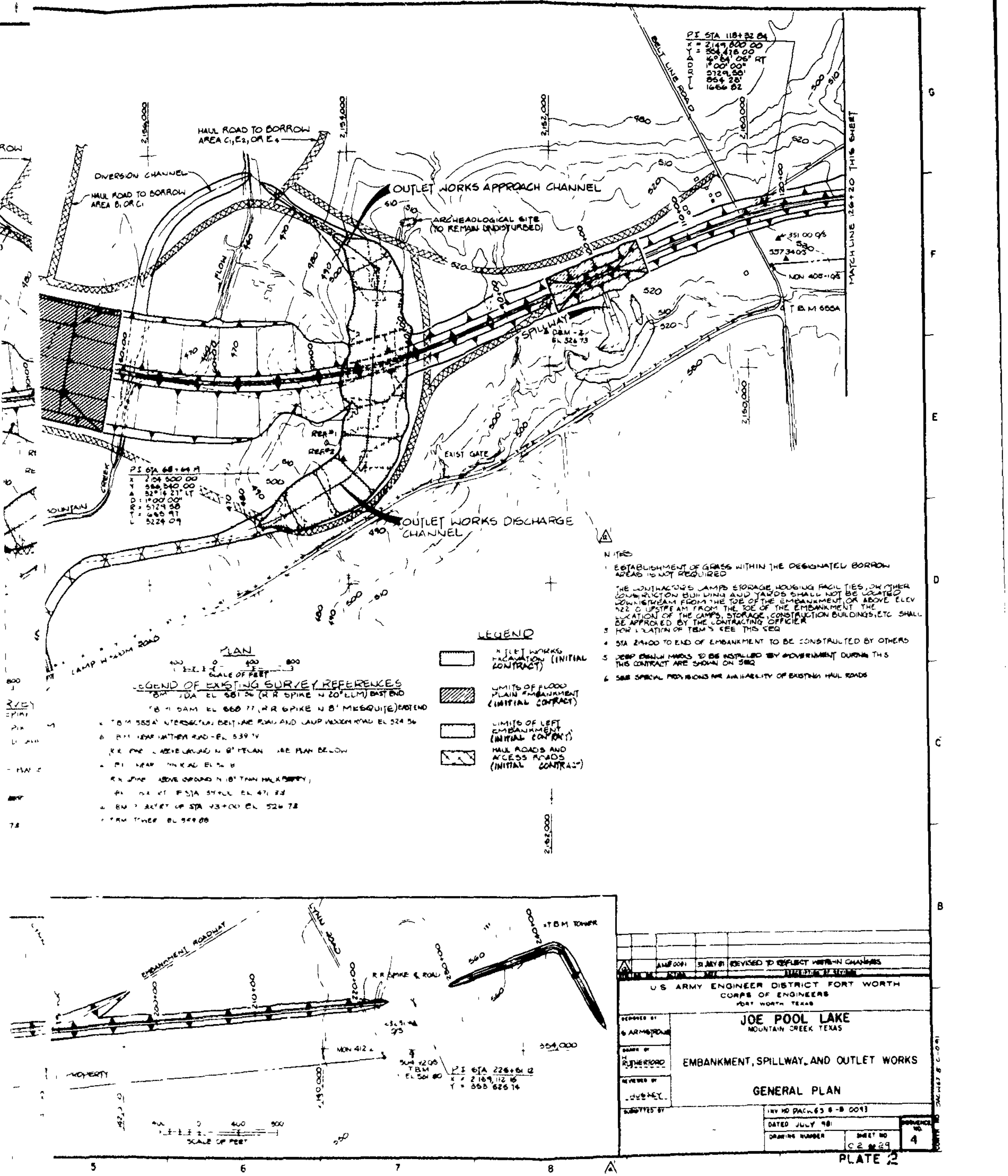
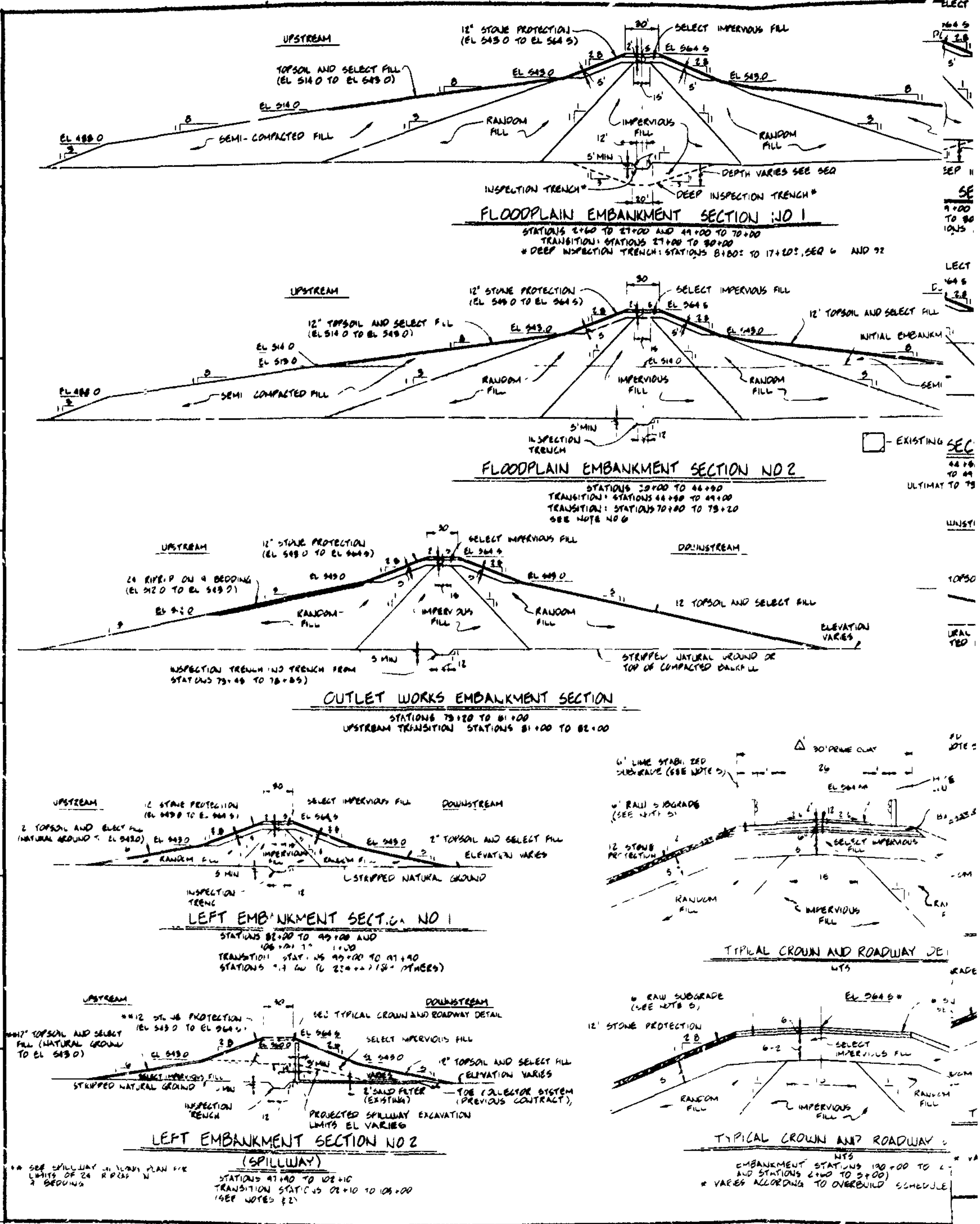

OKLA
ARK
NM
LA
PROJECT LOCATION
T E X A S
MEXICO
LEGEND
TOP OF CONSERVATION POOL EL 522 MSL
TOP OF FLOOD CONTROL POOL EL 536 M
APPROXIMATE LIMITS OF FEE ACQUISITION
APPROXIMATE LIMITS OF EASEMENT ACQUISITION
CEDAR HILL
BRITTON
MANSFIELD
WEBB PARK
MOUNTAIN CREEK
ELLIS CO
JOHNSON CO
TARRANT CO
360
PROPOSED
SCALE IN FEET
ENGINEERING DIVISION
DESIGN BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
JOE POOL LAKE
MOUNTAIN CREEK TEXAS
LAKE AND VICINITY MAP

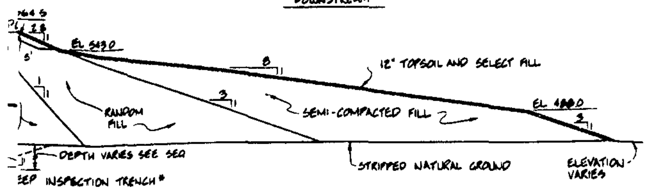
PLATE 1



PROJECT BUILDING AND VISITOR'S OVERLOOK
STA 2+60± START EMBANKMENT
T.B.M. NDA
T.B.M. SAM
HAUL ROAD TO BORROW AREA C1, E2, OR E4
DIVERSION CHANNEL
HAUL ROAD TO BORROW AREA B1 OR C1
FLOW
N
DBM I EL 471.33
MOUNTAIN CREEK
ABANDONED F.M. 582
F.M. 582
PLAN
SCALE OF FEET
LEGEND OF EXISTING SURVEY
TBM NDA EL 581.56 (R.R. SPIKE)
TBM SAM EL 588.77 (R.R. SPIKE)
EMBANKMENT ROADWAY
WAGNER ROAD
MATHEW ROAD
GOVERNMENT PROPERTY LINE
MON 484 I
MON 476 2
MON 405 2
354,000
356,000
358,000
360,000
2,162,000
2,160,000
2,158,000
2,156,000
G
F
E
D
C
B
A
1
2
3
4
5
6

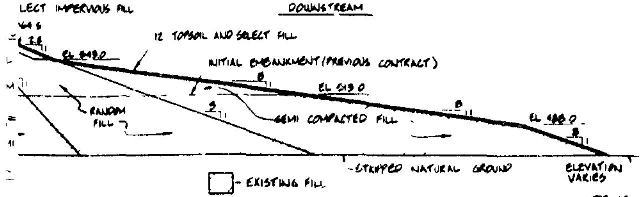

HAUL ROAD TO BORROW AREA C1, E2, OR E4
DIVERSION CHANNEL
HAUL ROAD TO BORROW AREA B1 OR C1
OUTLET WORKS APPROACH CHANNEL
ARCHEAOLOGICAL SITE (TO REMAIN UNDISTURBED)
BELT LINE ROAD
MATCH LINE 126+20 THIS SHEET
SPILLWAY
EXIST GATE
OUTLET WORKS DISCHARGE CHANNEL
MOUNTAIN CREEK
CAMP WISDOM ROAD
PLAN
SCALE OF FEET
LEGEND OF EXISTING SURVEY REFERENCES
LEGEND
OUTLET WORKS EXCAVATION (INITIAL CONTRACT)
LIMITS OF FLOOD PLAIN EMBANKMENT (INITIAL CONTRACT)
LIMITS OF LEFT EMBANKMENT (INITIAL CONTRACT)
HAUL ROADS AND ACCESS ROADS (INITIAL CONTRACT)
NOTES
1. ESTABLISHMENT OF GRASS WITHIN THE DESIGNATED BORROW AREAS IS NOT REQUIRED
2. THE CONTRACTOR'S CAMPS, STORAGE, HOUSING FACILITIES, OR OTHER CONSTRUCTION BUILDING AND YARDS SHALL NOT BE LOCATED DOWNSTREAM FROM THE TOE OF THE EMBANKMENT OR ABOVE ELEV 522 O UPSTREAM FROM THE TOE OF THE EMBANKMENT. THE LOCATION OF THE CAMPS, STORAGE, CONSTRUCTION BUILDINGS, ETC. SHALL BE APPROVED BY THE CONTRACTING OFFICER
3. FOR LOCATION OF TBM'S SEE THIS SEQ
4. STA 214+00 TO END OF EMBANKMENT TO BE CONSTRUCTED BY OTHERS
5. DEEP BENCH MARKS TO BE INSTALLED BY GOVERNMENT DURING THIS CONTRACT ARE SHOWN ON SEQ
6. SEE SPECIAL PROVISIONS FOR AVAILABILITY OF EXISTING HAUL ROADS
EMBANKMENT ROADWAY
LYNN ROAD
T B M TOWER
R R SPIKE & ROAD
PROPERTY
SCALE OF FEET
REVISED TO REFLECT WRITTEN CHANGES
U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS
JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
GENERAL PLAN
DATED JULY 1981
PLATE 2


UPSTREAM
12" STONE PROTECTION (EL 543.0 TO EL 564.5)
SELECT IMPERVIOUS FILL
TOPSOIL AND SELECT FILL (EL 514.0 TO EL 543.0)
EL 564.5
EL 543.0
EL 514.0
EL 488.0
SEMI-COMPACTED FILL
RANDOM FILL
IMPERVIOUS FILL
INSPECTION TRENCH*
DEEP INSPECTION TRENCH*
DEPTH VARIES SEE SEQ
FLOODPLAIN EMBANKMENT SECTION NO 1
STATIONS 2+60 TO 27+00 AND 49+00 TO 70+00
TRANSITION: STATIONS 27+00 TO 30+00
* DEEP INSPECTION TRENCH: STATIONS 8+80± TO 17+20±, SEQ 6 AND 92
12" TOPSOIL AND SELECT FILL (EL 514.0 TO EL 543.0)
EL 513.0
12" TOPSOIL AND SELECT FILL
INITIAL EMBANKMENT
INSPECTION TRENCH
EXISTING
FLOODPLAIN EMBANKMENT SECTION NO 2
STATIONS 30+00 TO 44+90
TRANSITION: STATIONS 44+90 TO 49+00
TRANSITION: STATIONS 70+00 TO 73+20
SEE NOTE NO 6
DOWNSTREAM
24" RIPRAP ON 9" BEDDING (EL 512.0 TO EL 543.0)
12" TOPSOIL AND SELECT FILL
ELEVATION VARIES
STRIPPED NATURAL GROUND OR TOP OF COMPACTED BACKFILL
INSPECTION TRENCH NO TRENCH FROM STATIONS 73+49 TO 76+85
OUTLET WORKS EMBANKMENT SECTION
STATIONS 73+20 TO 81+00
UPSTREAM TRANSITION STATIONS 81+00 TO 82+00
30' PRIME COAT
6" LIME STABILIZED SUBGRADE (SEE NOTE 5)
6" RAW SUBGRADE (SEE NOTE 5)
12" STONE PROTECTION
12" TOPSOIL AND SELECT FILL (NATURAL GROUND TO EL 543.0)
2" TOPSOIL AND SELECT FILL
STRIPPED NATURAL GROUND
LEFT EMBANKMENT SECTION NO 1
STATIONS 82+00 TO 95+00 AND
TRANSITION STATIONS 95+00 TO 97+90
TYPICAL CROWN AND ROADWAY DETAIL
NTS
** SEE SPILLWAY ... PLAN FOR LIMITS OF 24" RIPRAP ON 9" BEDDING
** 12" STONE PROTECTION (EL 543.0 TO EL 564.5)
SEE TYPICAL CROWN AND ROADWAY DETAIL
** 12" TOPSOIL AND SELECT FILL (NATURAL GROUND TO EL 543.0)
2' SAND FILTER (EXISTING)
TOE COLLECTOR SYSTEM (PREVIOUS CONTRACT)
PROJECTED SPILLWAY EXCAVATION LIMITS EL VARIES
LEFT EMBANKMENT SECTION NO 2 (SPILLWAY)
STATIONS 97+90 TO 102+10
TRANSITION STATIONS 102+10 TO 105+00
(SEE NOTES ...)
EMBANKMENT STATIONS 190+00 TO ... AND STATIONS 2+60 TO 5+00)
* VARIES ACCORDING TO OVERBUILD SCHEDULE



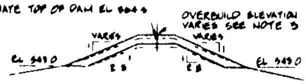
SECTION NO 1

9+00 TO 78+80
TO 30+00
IONS 8+80± TO 17+20±, SEQ 6 AND

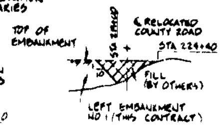


SECTION NO 2

44+00
TO 49+00
AT TO 73+20

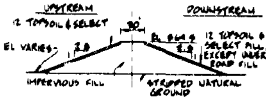


TYPICAL EMBANKMENT OVERBUILD SECTION



PROFILE

NTS

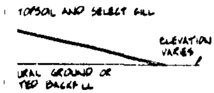


SECTION

STATIONS 214+00 TO 224+40 (BY OTHERS)

NTS

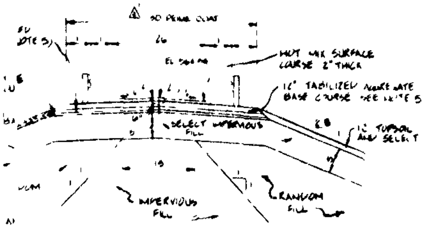
UPSTREAM



MATERIALS SOURCE AND PLACEMENT SUMMARY					
ZONE		CLASSIFICATION & LIQUID LIMIT (LL) REQUIRED	PLACEMENT MOISTURE CONTENT	REQUIRED COMPACTIVE EFFORT AND DENSITY	MATERIALS SOURCE
IMPERVIOUS FILL		CH & CL LL ≥ 40	OPTIMUM TO 4% ABOVE OPTIMUM	6 PASSES OF SHEEPSFOOT ROLLER 8 MAX UNCOMPACTED LIFT	BORROW AREAS
RANDOM FILL		SUITABLE OVERBURDEN	2% BELOW OPTIMUM TO 3% ABOVE OPTIMUM		
TOPSOIL AND SELECT FILL		STRIPPINGS &/OR SELECT FILL W/LL ≤ 60			REQUIRED STRIPPING & BORROW AREAS
SEMI COMPACTED FILL		SUITABLE OVERBURDEN & PRIMARY MATERIALS	5% BELOW OPTIMUM TO 4% ABOVE OPTIMUM	2 PASSES OF PNEUMATIC ROLLER, 12 MAX UNCOMPACTED LIFT	REQUIRED EXCAVATION & BORROW AREAS
FILTER MATERIAL		SPECIFIED ELSEWHERE	SATURATED BY SPRINKLING DURING COMPACTION	4 PASSES OF VIBRATORY COMPACTOR	COMMERICAL SOURCES
SELECT IMPERVIOUS FILL		LL & CH 30 ≤ LL ≤ 60	OPTIMUM TO 3% ABOVE OPTIMUM	6 PASSES OF SHEEPSFOOT ROLLER 8 UNCOMPACTED LIFT	BORROW AREAS
RIPRAP AND BEDDING		SEE SPECIFICATIONS FOR GRADATION	SEE SPECIFICATIONS	SEE SPECIFICATIONS	COMMERCIAL SOURCES
STRUCTURAL BACKFILL	NON EXPANSIVE FILL	3 MAX SIZE PI ≤ 12 & 10% PASSING NO 200 SIEVE	SATURATED BY SPRINKLING DURING COMPACTION	4 PASSES OF VIBRATORY COMPACTOR 6" MAX UNCOMPACTED LIFT	COMMERCIAL SOURCES
	IMPERVIOUS FILL	CH & CL LL ≥ 40	OPTIMUM TO 3% ABOVE OPTIMUM	6 PASSES OF SHEEPSFOOT ROLLER ON 8 MAX UNCOMPACTED LIFT & DRY DENSITY ≥ 95% STANDARD DENSITY	BORROW AREAS

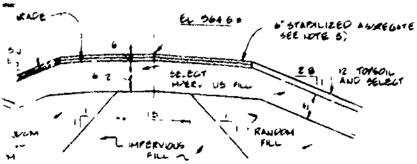
40 0 40 80

SCALE IN FEET



TYPICAL CROWN AND ROADWAY DETAIL NO 1

NTS

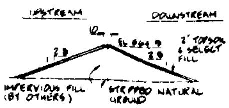


TYPICAL CROWN AND ROADWAY DETAIL NO 2

NTS

EMBANKMENT STATIONS 130+00 TO 219+00 AND STATIONS 2+60 TO 5+00)

* VARIES ACCORDING TO OVERBUILD SCHEDULE, SEE NOTE 3



TYPICAL DIKE SECTION

(BY OTHERS)

NTS

STATIONS 228+00 TO 249+60

NOTES

1. SEE SEQ __ FOR ADDITIONAL LEFT EMBANKMENT NO 2 ZONING REQUIREMENTS, EXTENT OF EXISTING LEFT EMBANKMENT NO 2 AND APPROXIMATE LIMITS OF REQUIRED SPILLWAY EXCAVATION IN THIS CONTRACT
2. INITIAL EMBANKMENTS WERE CONSTRUCTED UNDER THE PREVIOUS CONTRACT FROM STATION 27+00 TO STATION 49+00 TO ELEVATION 514 0 AND FROM STATION 95+00 TO STATION 105+00 TO ELEVATION 564 5
3. ELEVATIONS ON TYPICAL EMBANKMENT SECTIONS ARE ULTIMATE ELEVATIONS. OVERBUILD SHALL BE APPLIED TO THE CROWN AND UPPER 1V ON 2 8H EMBANKMENT SLOPES IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:

STATION	OVERBUILD, FT
2+60	0
15+00	1 5
60+00	1 5
75+00	0 75
80+00	0 75
85+00	0
219+00	0

OVERBUILD AT ANY POINT BETWEEN THE ABOVE LISTED STATIONS SHALL BE DETERMINED BY LINEAR INTERPOLATION

4. THE STONE PROTECTION, RIPRAP, BEDDING, AND TOPSOIL AND SELECT FILL SHALL BE MEASURED PERPENDICULAR TO THE SLOPE BEING PROTECTED
5. SEE SPECIFICATIONS FOR DENSITY OF ROADWAY MATERIALS
6. ZONING FOR THE UPSTREAM COFFERDAM IS SHOWN ON

A	AM#0001	31 JUL 81	REVISED TO REFLECT W S CHANGES

U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T SCHMIDT
DRAWN BY R REED
REVIEWED BY T SCHMIDT
SUBMITTED BY

JOE POOL LAKE

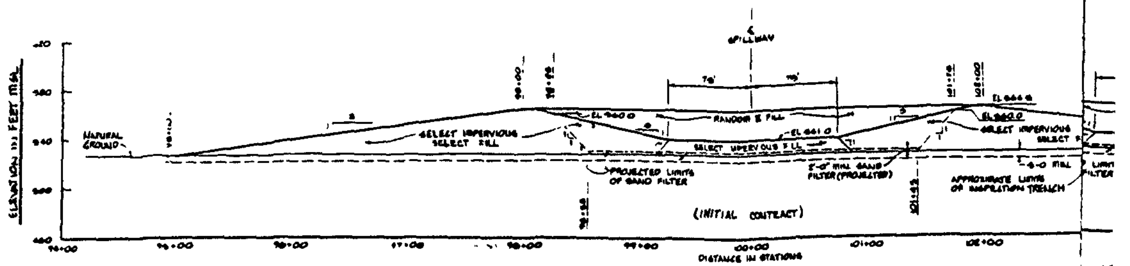
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

TYPICAL EMBANKMENT SECTIONS I

INV NO DACW63-81-B-0093
DATED JULY '81
DRAWING NUMBER
SHEET NO 10 OF 43

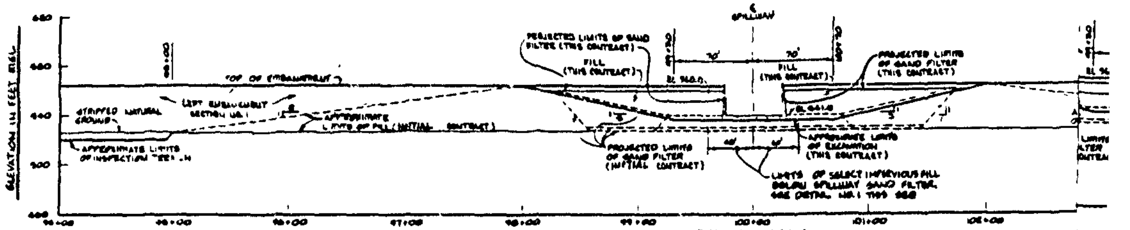
PLATE 3



(INITIAL CONTRACT)

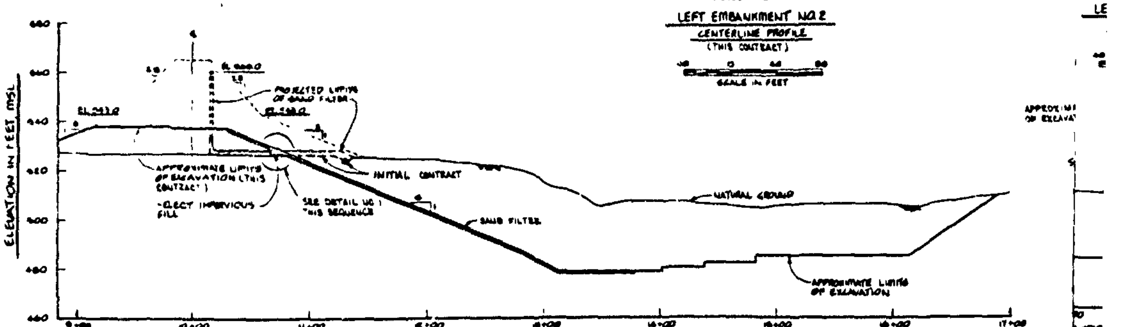
LEFT EMBANKMENT NO. 2
CENTERLINE PROFILE
(EXISTING)

SCALE IN FEET



LEFT EMBANKMENT NO. 2
CENTERLINE PROFILE
(THIS CONTRACT)

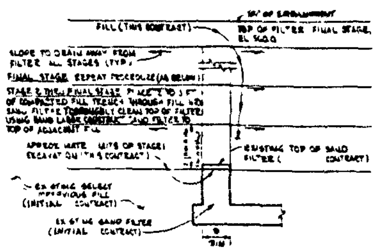
SCALE IN FEET



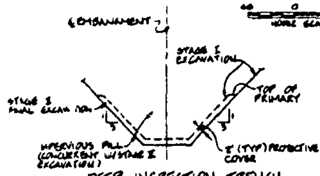
LEFT EMBANKMENT NO. 2 (SPILLWAY)
SECTION AT CENTERLINE SPILLWAY
THIS CONTRACT

VERT SCALE IN FEET

HORIZ SCALE IN FEET



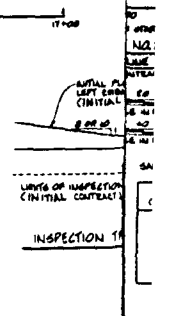
VERTICAL SAND FILTER CONSTRUCTION DETAIL
NTS



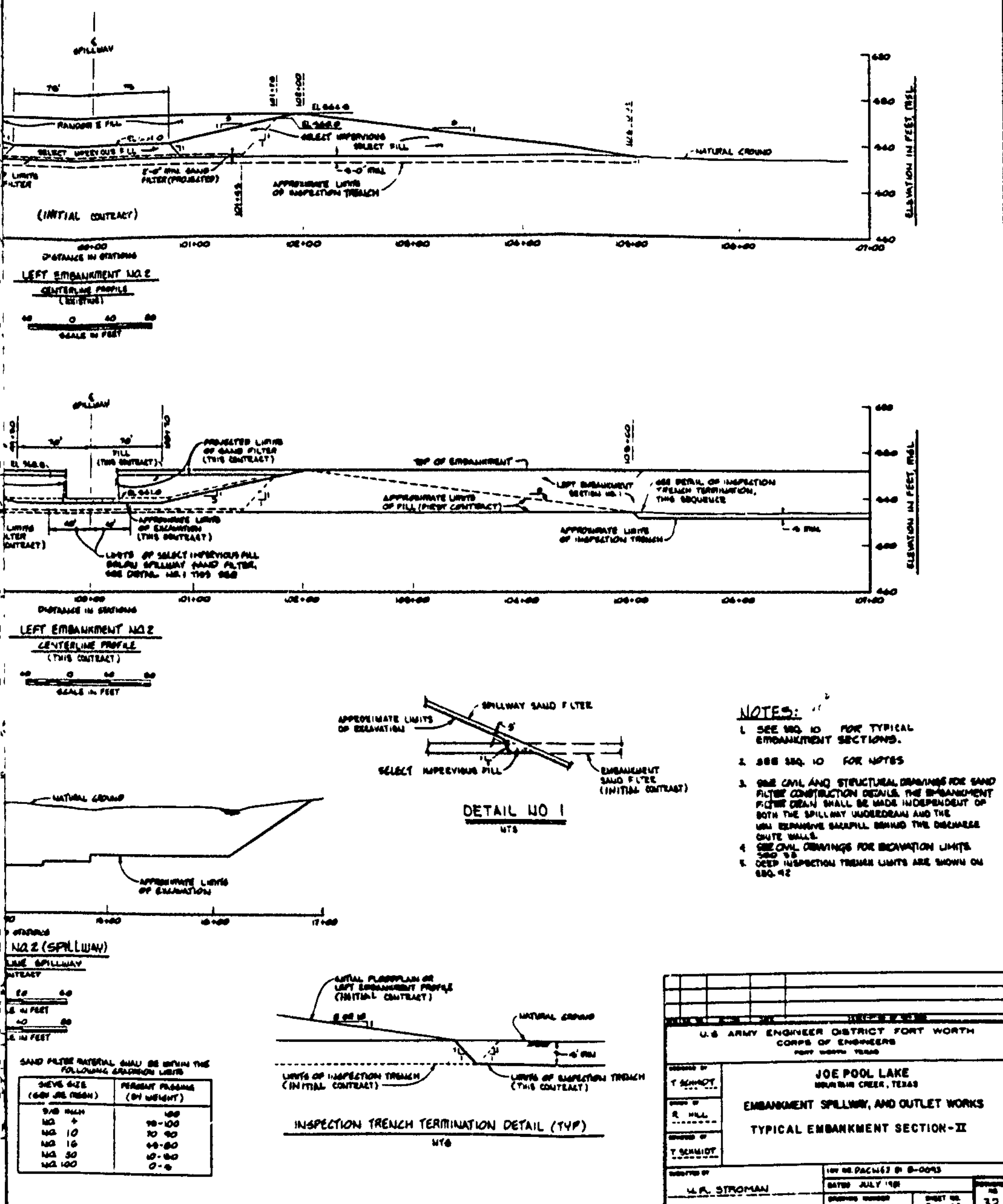
DEEP INSPECTION TRENCH
CONSTRUCTION STAGING
NTS

SAND FILTER MATERIAL SHALL BE WITHIN THE FOLLOWING GRADATION LIMITS

SIEVE SIZE (SQUARE MESH)	PERCENT PASSING (BY WEIGHT)
3/8 INCH	100
NO. 4	95-100
NO. 10	70-90
NO. 1"	45-80
NO. 50	10-30
NO. 100	0-5



INSPECTION T



SAND FILTER MATERIAL SHALL BE WITHIN THE FOLLOWING GRADATION LIMITS

SIEVE SIZE (U.S. STD. MESH)	PERCENT PASSING (BY WEIGHT)
3/8 INCH	100
NO. 4	95-100
NO. 10	70 90
NO. 16	45-80
NO. 50	10-30
NO. 100	0-5

NOTES:

1. SEE SEQ. 10 FOR TYPICAL EMBANKMENT SECTIONS.
2. SEE SEQ. 10 FOR NOTES
3. SEE CIVIL AND STRUCTURAL DRAWINGS FOR SAND FILTER CONSTRUCTION DETAILS. THE EMBANKMENT FILTER DRAIN SHALL BE MADE INDEPENDENT OF BOTH THE SPILLWAY UNDERDRAIN AND THE NON EXPANSIVE BACKFILL BEHIND THE DISCHARGE CHUTE WALLS.
4. SEE CIVIL DRAWINGS FOR EXCAVATION LIMITS. SEQ 38
5. DEEP INSPECTION TRENCH LIMITS ARE SHOWN ON SEQ. 42

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

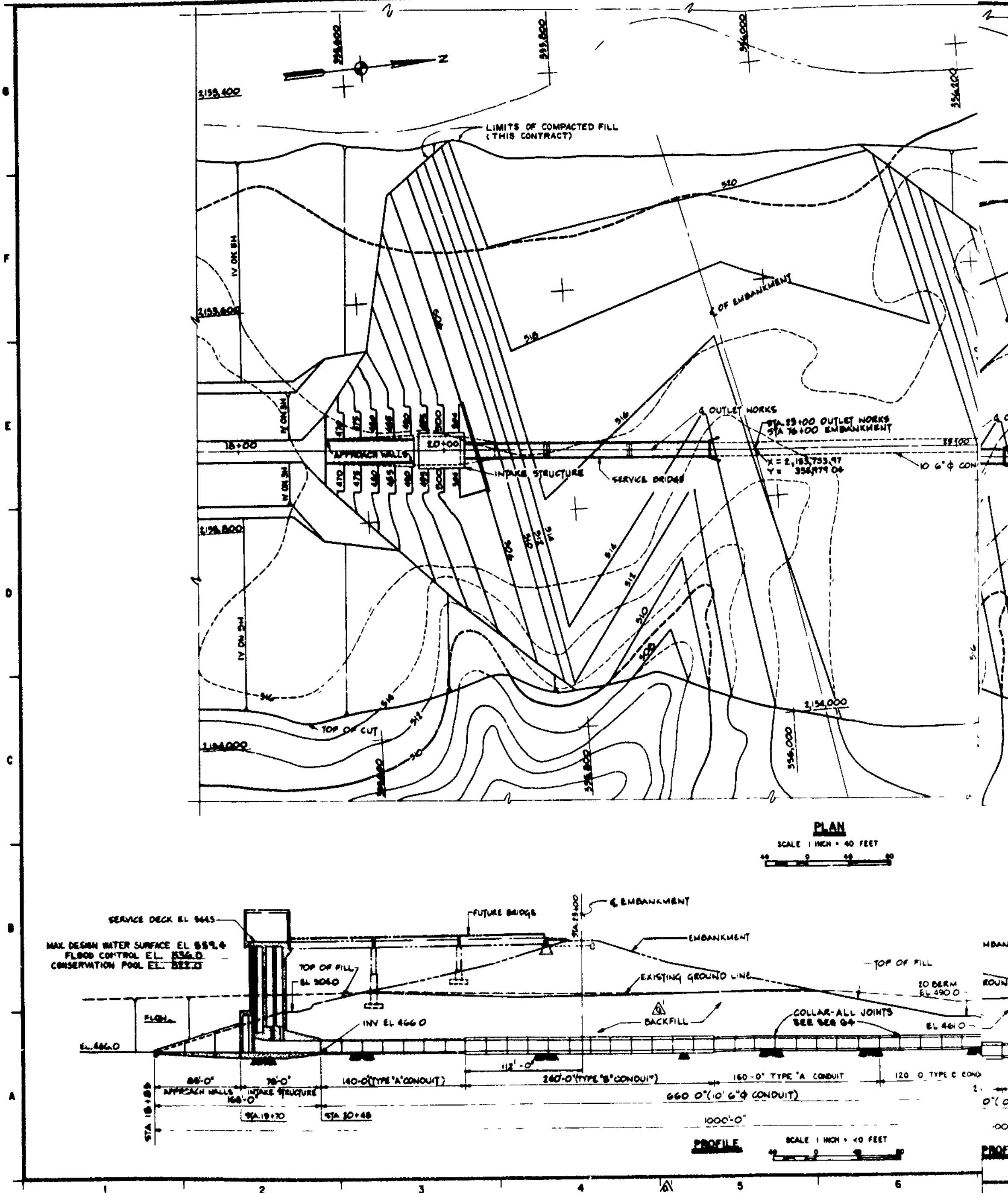
EMBANKMENT SPILLWAY, AND OUTLET WORKS

TYPICAL EMBANKMENT SECTION-II

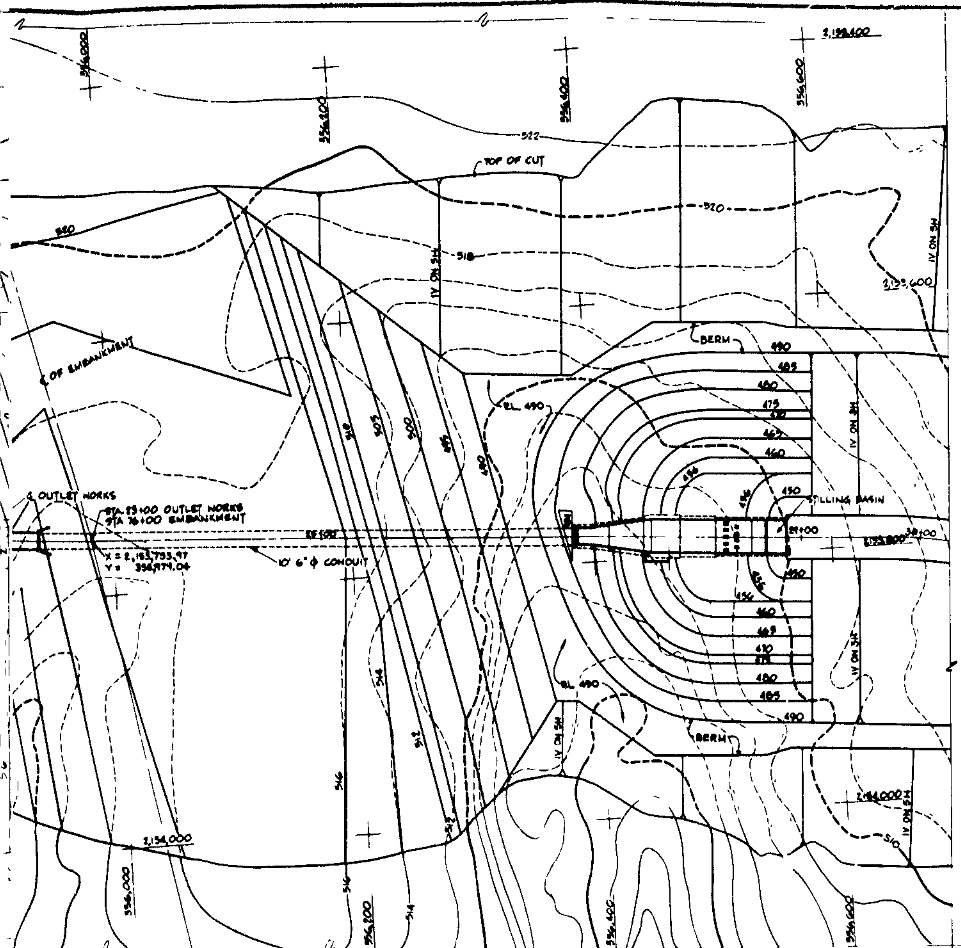
DESIGNED BY T. SCHMIDT
DRAWN BY R. HILL
CHECKED BY T. SCHMIDT
SUBMITTED BY H.R. STROMAN

INV. NO. DACW63 81 B-0093
DATED JULY 1981
SHEET NO. 2 OF 43
SEQUENCE NO. 32

PLATE 4



LIMITS OF COMPACTED FILL (THIS CONTRACT)
2,153,400
2,153,600
2,153,800
2,154,000
355,800
356,000
356,200
520
518
516
514
512
510
508
506
℄ OF EMBANKMENT
℄ OUTLET WORKS
STA. 23+00 OUTLET WORKS
STA 76+00 EMBANKMENT
X = 2,153,753.97
Y = 355,979.04
18+00
20+00
APPROACH WALLS
INTAKE STRUCTURE
SERVICE BRIDGE
10' 6" ⌀ CON
TOP OF CUT
1V ON 3H
1V ON 2H
PLAN
SCALE 1 INCH = 40 FEET
SERVICE DECK EL 564.5
MAX. DESIGN WATER SURFACE EL 559.4
FLOOD CONTROL EL. 536.0
CONSERVATION POOL EL. 522.0
FUTURE BRIDGE
℄ EMBANKMENT
STA. 23+00
EMBANKMENT
TOP OF FILL
EL 504.0
EXISTING GROUND LINE
20 BERM EL 490.0
FLOW
INV EL 466.0
BACKFILL
COLLAR-ALL JOINTS SEE SEC G4
EL 461.0
EL. 466.0
112'-0"
88'-0" APPROACH WALLS
78'-0" INTAKE STRUCTURE
166'-0"
140-0"(TYPE 'A' CONDUIT)
240'-0"(TYPE 'B' CONDUIT)
160-0" TYPE 'A' CONDUIT
120-0 TYPE C COND
660 0"(10' 6" ⌀ CONDUIT)
1000'-0"
STA 18+84
STA 19+70
STA 20+48
PROFILE
SCALE 1 INCH = 40 FEET
1
2
3
4
5
6
B
C
D
E
F
G



PLAN

SCALE 1 INCH = 40 FEET

LEGEND

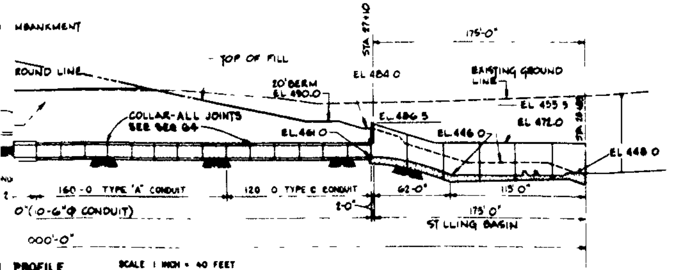
465 —— FINISHED GRADE CONTOUR

--- 518 --- EXISTING CONTOUR

NOTES

1. SEE SEQ 19 FOR APPROACH WALLS, SEQ 22 FOR INTAKE STRUCTURE, SEQ 64 FOR CONDUIT AND SEQ 65 FOR STILLING BASIN
2. SEE SEQ 14 FOR EXCAVATION PLAN
3. SEE SEQ 15 & 16 FOR SECTIONS AND PROFILES OF FILL

RECORD DRAWING-WORK AS BUILT



PROFILE

SCALE 1 INCH = 40 FEET

A	19 OCT 79	REVISED TO REFLECT W I. CHANGES

U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY R.W.-R.S.A.
DRAWN BY C.M.B.
CHECKED BY J.W.H.
SUBMITTED BY
ENGINEER

JOE POOL LAKE

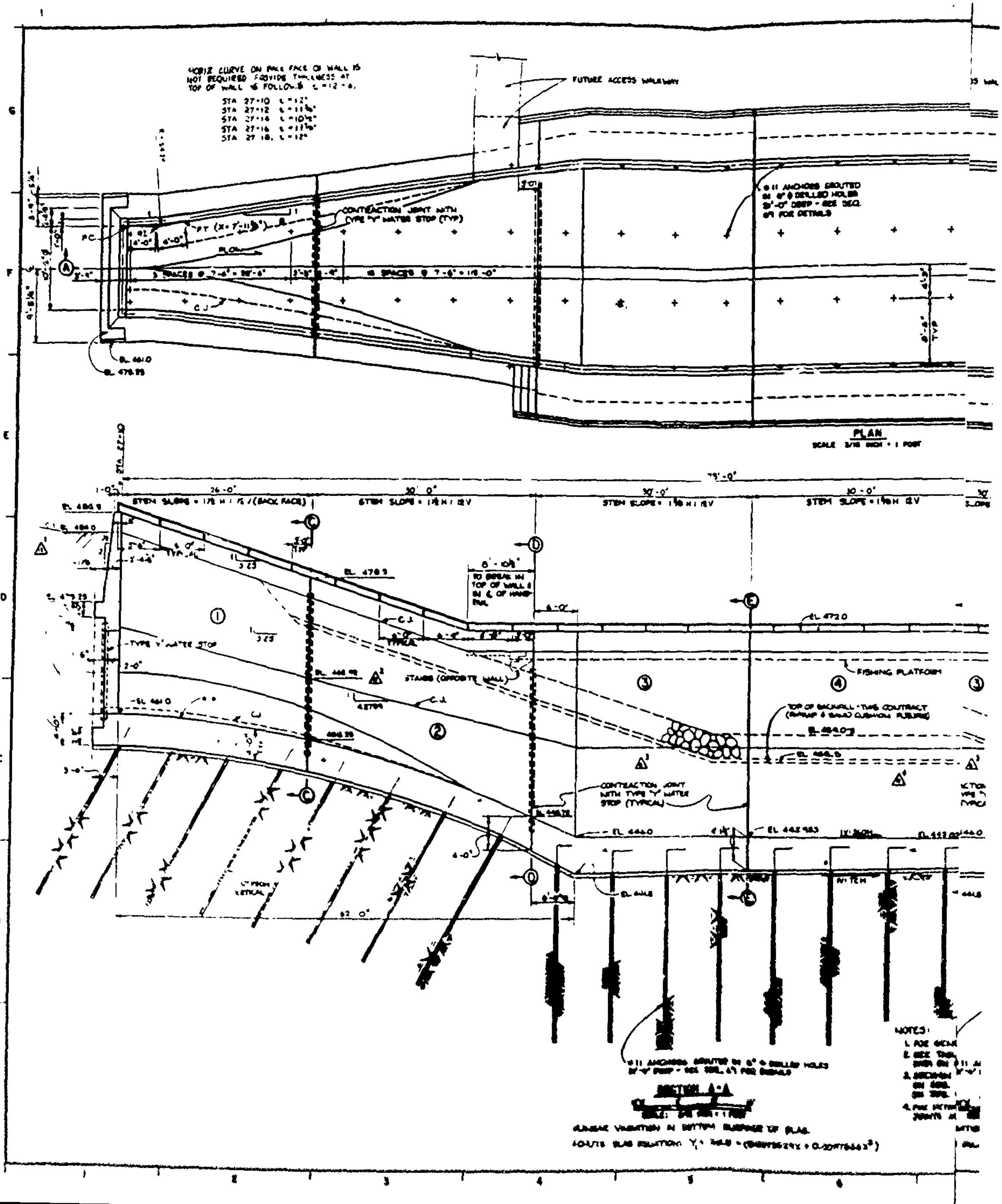
MOUNTAIN CREEK, TEXAS

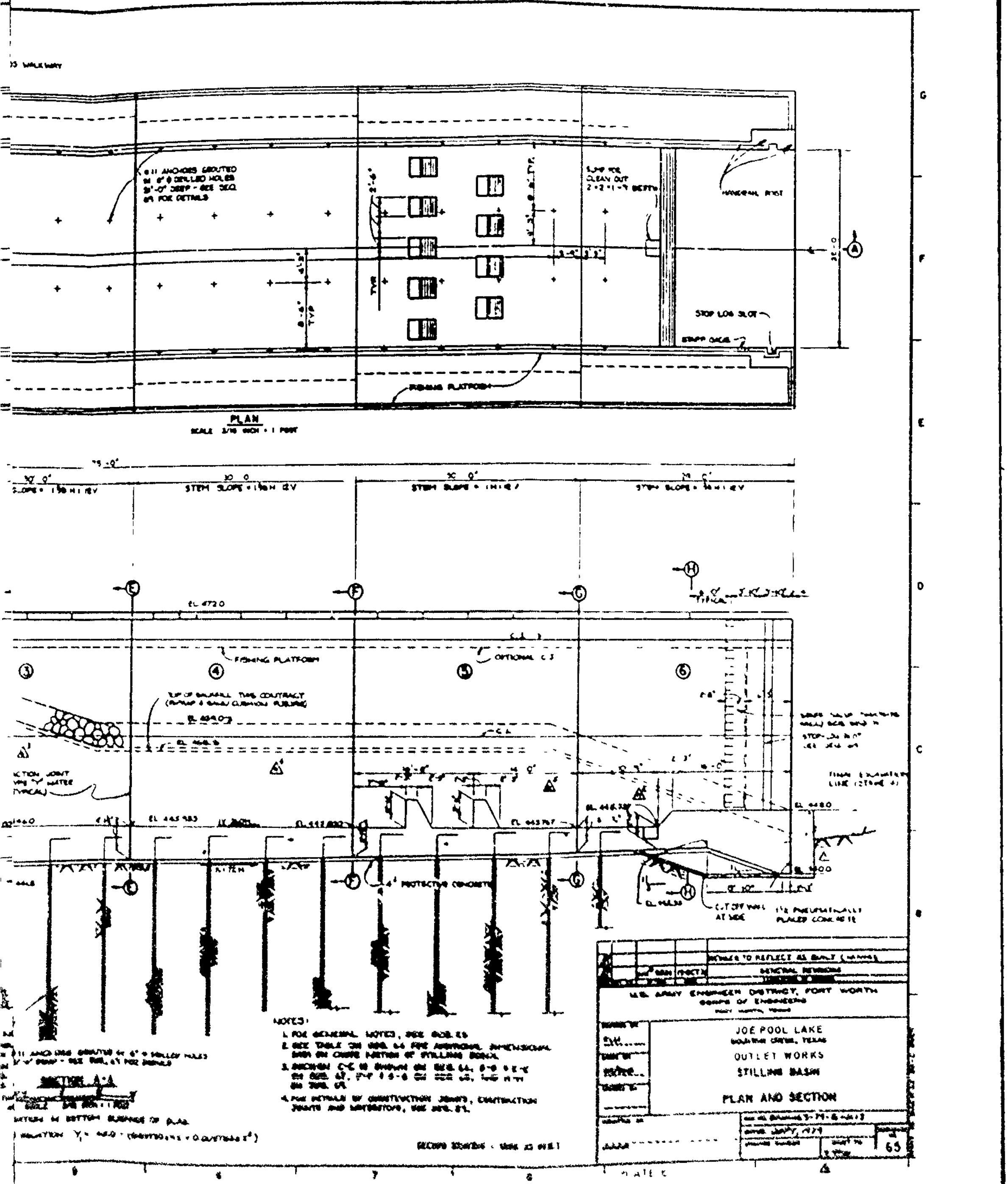
OUTLET WORKS

PLAN AND PROFILE

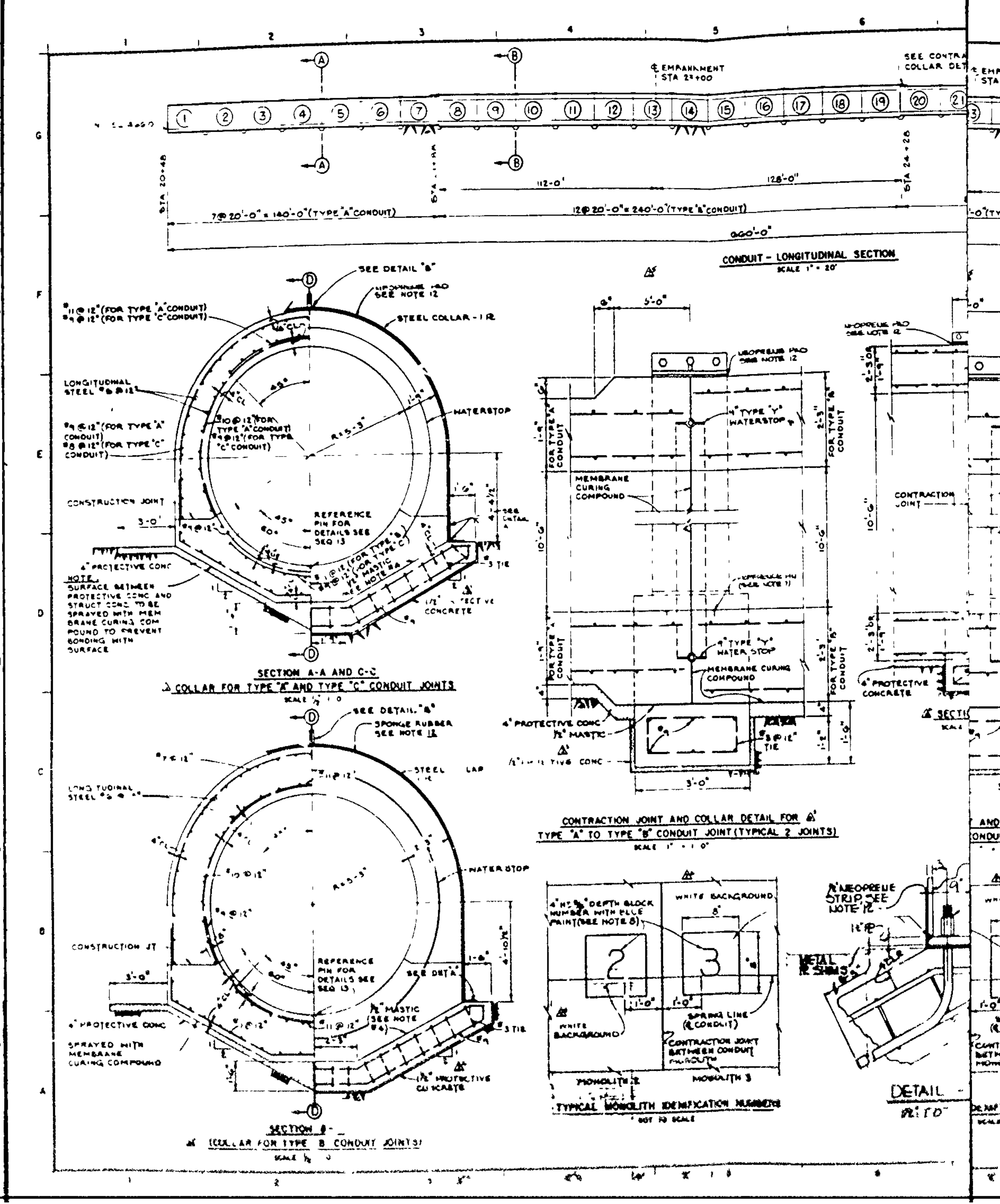
INV NO DACW63-79-B-0113
DATED SEPT 1979
DRAWING NUMBER
SHEET NO S-1
18

PLATE 5

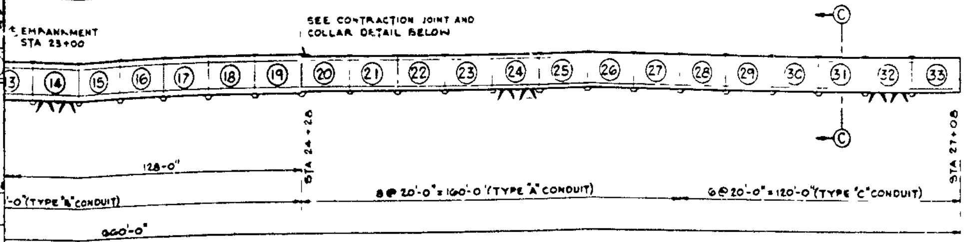

FUTURE ACCESS WALKWAY
STA 27+10
STA 27+12
STA 27+14
STA 27+16
STA 27+18
CONTRACTION JOINT WITH TYPE "Y" WATER STOP (TYP)
FLOW
C.J.
EL 461.0
EL 478.25
PLAN
STEM SLOPE
EL 478.5
TO BREAK IN TOP OF WALL
TYPE "Y" WATER STOP
STAIRS (OPPOSITE WALL)
EL 472.0
FISHING PLATFORM
TOP OF BACKFILL - THIS CONTRACT
CONTRACTION JOINT WITH TYPE "Y" WATER STOP (TYPICAL)
EL 446.0
NOTES:
SECTION A-A



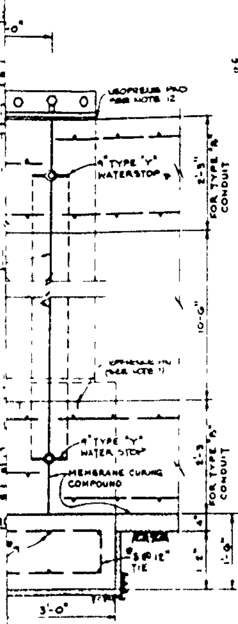
PLAN
HANDRAIL POST
STOP LOG SLOT
FISHING PLATFORM
STEM SLOPE
EL 472.0
OPTIONAL
4" PROTECTIVE CONCRETE
CUT OFF WALL AT SIDE
NOTES:
SECTION A-A
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
JOE POOL LAKE
OUTLET WORKS
STILLING BASIN
PLAN AND SECTION
65



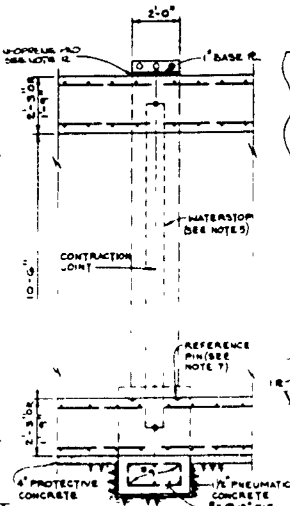
℄ EMBANKMENT STA 22+00
SEE CONTRACTION COLLAR DET
7@ 20'-0" = 140'-0" (TYPE "A" CONDUIT)
12@ 20'-0" = 240'-0" (TYPE "B" CONDUIT)
112'-0"
128'-0"
CONDUIT - LONGITUDINAL SECTION
SCALE 1" = 20'
SEE DETAIL "B"
STEEL COLLAR - 1 R
LONGITUDINAL STEEL
WATERSTOP
CONSTRUCTION JOINT
REFERENCE PIN FOR DETAILS SEE SEQ 13
4" PROTECTIVE CONC
NOTE. SURFACE BETWEEN PROTECTIVE CONC AND STRUCT CONC TO BE SPRAYED WITH MEMBRANE CURING COMPOUND TO PREVENT BONDING WITH SURFACE
SECTION A-A AND C-C
COLLAR FOR TYPE "A" AND TYPE "C" CONDUIT JOINTS
4" TYPE "Y" WATERSTOP
MEMBRANE CURING COMPOUND
4" PROTECTIVE CONC
½" MASTIC
CONTRACTION JOINT AND COLLAR DETAIL FOR TYPE "A" TO TYPE "B" CONDUIT JOINT (TYPICAL 2 JOINTS)
SCALE 1" = 1'-0"
SPONGE RUBBER SEE NOTE 12
CONSTRUCTION JT
SEE DETAIL "A"
SPRAYED WITH MEMBRANE CURING COMPOUND
SECTION B-
(COLLAR FOR TYPE B CONDUIT JOINTS)
WHITE BACKGROUND
SPRING LINE (℄ CONDUIT)
CONTRACTION JOINT BETWEEN CONDUIT MONOLITH
MONOLITH 2
MONOLITH 3
TYPICAL MONOLITH IDENTIFICATION NUMBERS
NOT TO SCALE
½" NEOPRENE STRIP, SEE NOTE 12
METAL SHIMS
DETAIL
CONTRACTION JOINT
4" PROTECTIVE CONCRETE



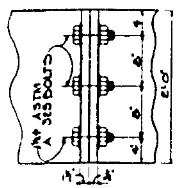
CONDUIT - LONGITUDINAL SECTION
SCALE 1" = 20'



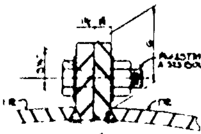
... AND COLLAR DETAIL FOR A CONDUIT JOINT (TYPICAL 2 JOINTS)



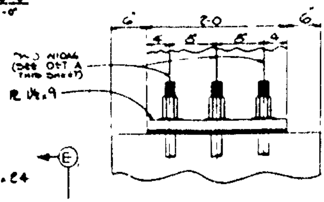
SECTION D-D
SCALE: ½" = 1'-0"



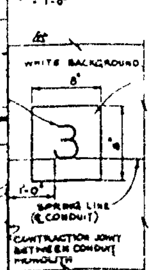
PLAN
1½" = 1'-0"



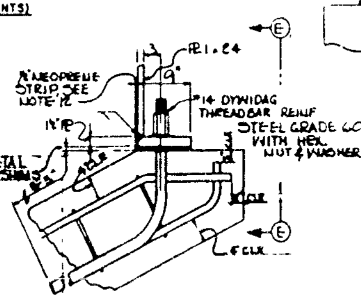
DETAIL B



VIEW E E



...DENTIFICATION NUMBERS



DETAIL A

NOTES

1 FOR GENERAL NOTES, SEE SEQ 23
2 CONCRETE FOR CONDUIT SHALL BE 4000 PSI COMPRESSIVE STRENGTH AT 28 DAYS
3 LONGITUDINAL BARS SHALL NOT EXTEND THRU CONTRUCTION OR EXPANSION JOINTS.
4 MASTIC TO BE ½" MIN OF ASBESTOS-FIBER BITUMINOUS MASTIC. APPLY PRIMER COAT TO CONCRETE AND APPLY MASTIC IN SEVERAL COATS ALLOWING EACH COAT TO DRY BEFORE SUCCESSIVE COATS
5 FOR WATER STOP DETAIL, SEE SEQ 59
7 SEE SEQ 13 FOR REFERENCE PIN DETAIL
8 SEE DETAIL FOR MONOLITH IDENTIFICATION NUMBERS TO BE PAINTED AT EACH CONDUIT CONTRACTION JOINTS SEE SPECIFICATIONS FOR TYPE OF PAINT
9 ALL STEEL PLATE SHALL CONFORM TO ASTM A 36, STEEL AND ALL BOLTS SHALL CONFORM TO ASTM A-325
10 THE STEEL COLLARS SHALL BE COATED COMPLETELY WITH COAL TAR EPOXY BEFORE DAMAGE TO THE COATING DURING INSTALLATION SHALL BE RECOATED THE ATTACHING BOLTS AND PROTRUDING PART OF THE DYWIDAG BAR AND HEX NUT SHALL BE COATED WITH COAL TAR EPOXY AFTER INSTALATION
11 THE ARC LENGTH OF THE STEEL COLLARS SHALL BE DETERMINED TAKING INTO ACCOUNT THE CONSTRUCTION TOLERANCES FOR THE CONDUIT STEEL PLATES CA[illegible] BE USED AS SHIMS IN THE CONNECTIONS SHIMS SHOULD ALSO BE COATED WITH COAL TAR EPOXY BEFORE INSTALATION AND BE THE SAME SIZE AS THE CONNECTION WHERE USED
12 [illegible] TIGHTLY BUTTED STRIPS OF NEOPRENE IN LIEU OF CONTINOUS STRIPS WITH [illegible] SHALL BE PLACED BETWEEN THE CONDUIT AND STEEL COLLAR THE COLLAR SHALL BE TIGHTENED [illegible] AS NECESSARY [illegible] IN AN INITIAL COMPRESSION IN THE NEOPRENE WITH FULL BEARING CONTACT IN THE CONNECTIONS
13 CONTRACTOR MAY, AT HIS OPTION, ELECT TO INSTALL STEEL COLLARS AS PART OF THE CONDUIT CONCRETE PLACEMENT OPERATION ELECTION TO USE THIS OPTION SHALL REQUIRE MEETING THE FOLLOWING REQUIREMENTS
   a TOLERANCES FOR THE EXTERIOR SURFACE OF STEEL COLLARS SHALL MEET THE REQUIREMENTS CLASS "C" FINISH
   b CONTRACTOR'S SHOP DRAWINGS FOR FORMING EQUIPMENT USED IN CONDUIT CONCRETE PLACEMENT SHALL INCLUDE DESIGN PROVISIONS AND DETAILS TO VERIFY THAT STEEL COLLARS AND NEOPRENE STRIPS PLACED IN A CONDUIT MONOLITH CAN BE HELD IN PLANNED POSITION, WITHOUT DAMAGE, DURING PLACEMENT OF THE ADJACENT CONDUIT MONOLITH

RECORD DRAWING WORK AS BUILT

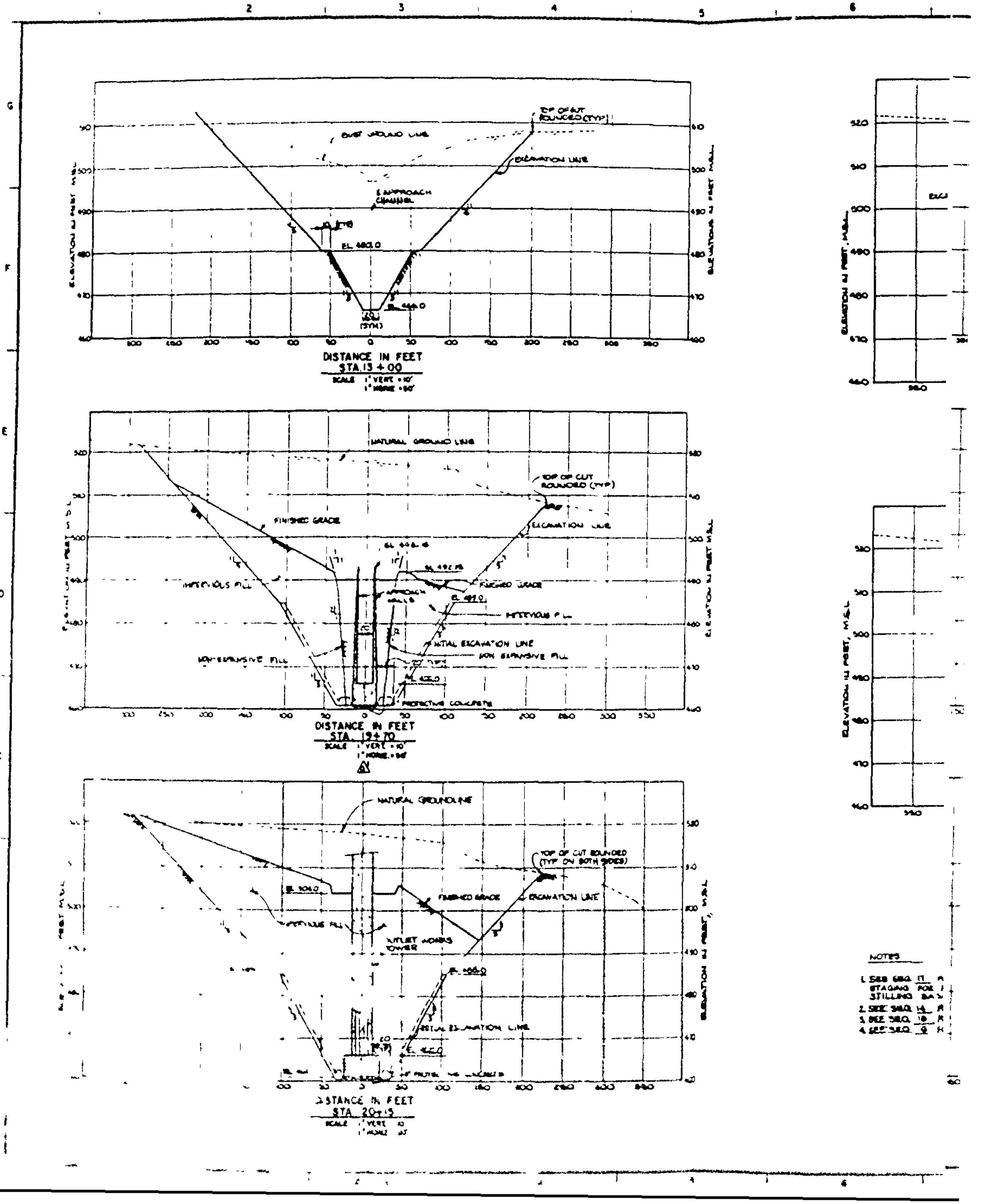
	REVISED TO REFLECT AS BUILT CHANGES
	REVISED NOTE
	REVISED TO REFLECT [illegible] CHANGES

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

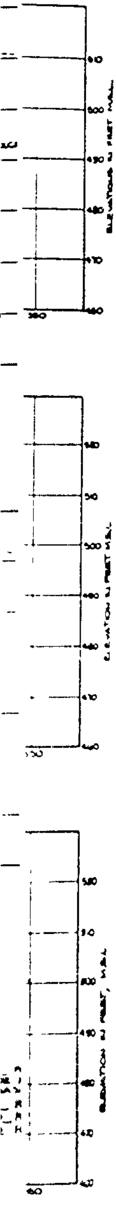
JOE POOL LAKE
MOUNTAIN CREEK TEXAS

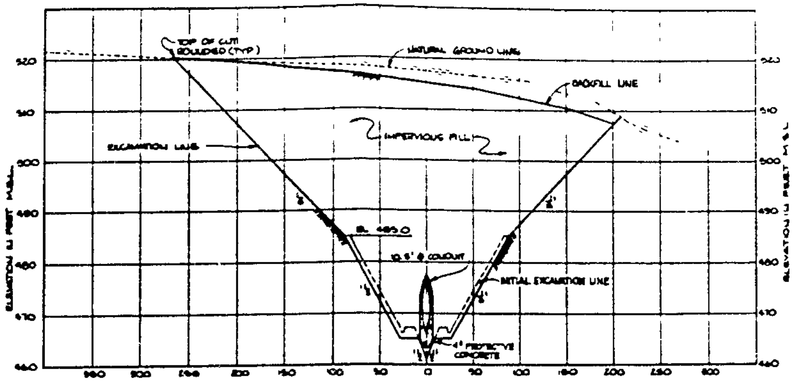
OUTLET WORKS

CONDUIT DETAILS

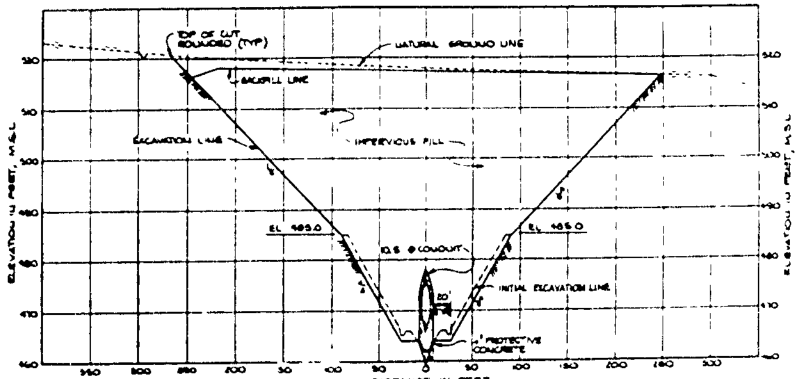


EXIST GROUND LINE
TOP OF CUT ROUNDED (TYP)
EXCAVATION LINE
℄ APPROACH CHANNEL
EL 480.0
ELEVATION IN FEET M.S.L.
DISTANCE IN FEET
STA. 13+00
NATURAL GROUND LINE
TOP OF CUT ROUNDED (TYP)
FINISHED GRADE
EXCAVATION LINE
IMPERVIOUS FILL
APPROACH WALLS
INITIAL EXCAVATION LINE
NON EXPANSIVE FILL
PROTECTIVE CONCRETE
DISTANCE IN FEET
STA. 19+70
NATURAL GROUNDLINE
TOP OF CUT ROUNDED (TYP ON BOTH SIDES)
FINISHED GRADE
EXCAVATION LINE
IMPERVIOUS FILL
OUTLET WORKS TOWER
INITIAL EXCAVATION LINE
DISTANCE IN FEET
STA. 20+15
NOTES





DISTANCE IN FEET
STA 21+90
SCALE 1" VERT = 10'
1" HORIZ = 50'



DISTANCE IN FEET
STA 24+30
SCALE 1" VERT = 10'
1" HORIZ = 50'

NOTES

1. SEE SHQ. 13 FOR REQUIRED EXCAVATION AND BACK FILLING STAGING FOR FOUNDATION PROTECTION AND DIMENSIONS AT STILLING BASIN WALL BASE
2. SEE SHQ. 14 FOR EXCAVATION PLAN.
3. SEE SHQ. 10 FOR FINISHED GRADE PLAN
4. SEE SHQ. 10 FOR PROFILE OF NON EXPANSIVE FILL

GENERAL REVISIONS

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

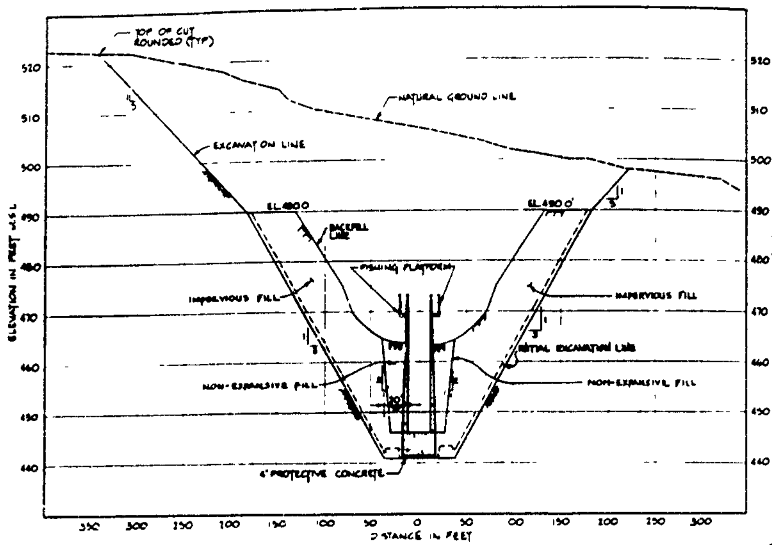
OUTLET WORKS
APPROACH CHANNEL, TOWER AND CONDUIT
SECTIONS

DRAWN BY: HLR

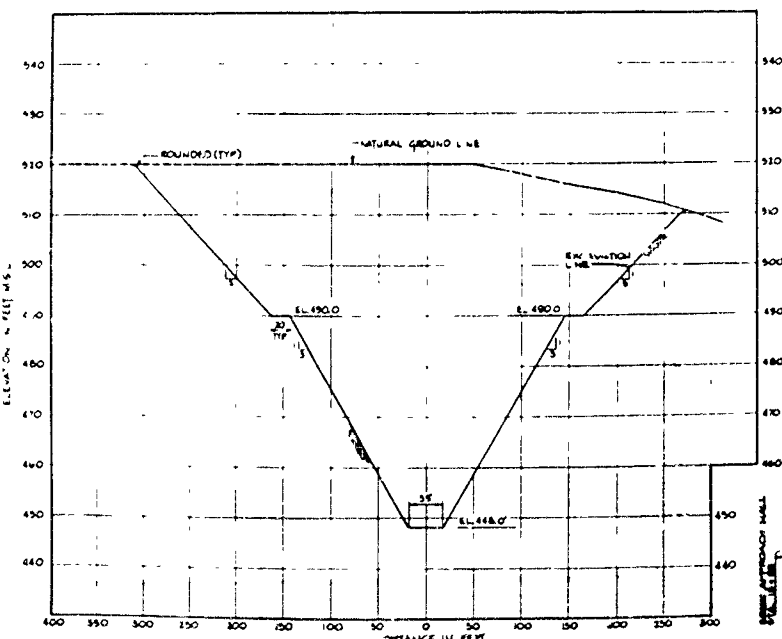
INV. NO. DACW63-79-B-0113
DATED SEPT, 1979

15

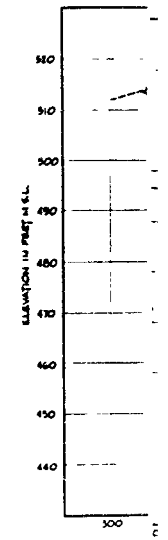
PLATE 9

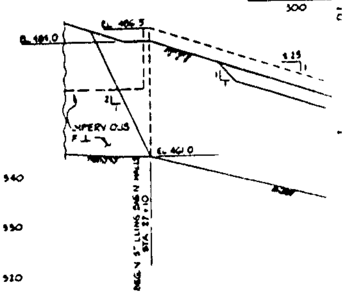


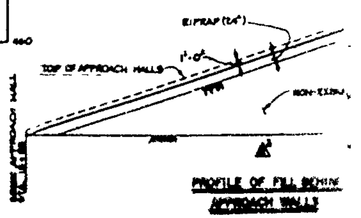
STA. 27+72
SCALE: 1" VERT = 10'
1" HORIZ = 50'



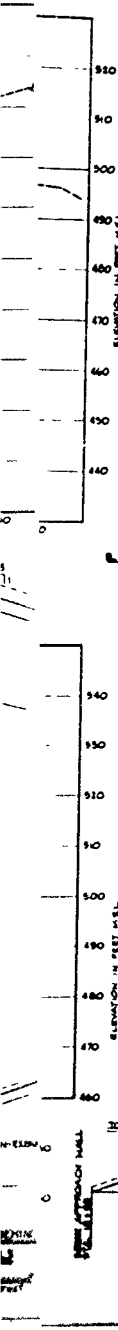
STA. 31+40
SCALE: 1" VERT = 10'
1" HORIZ = 50'

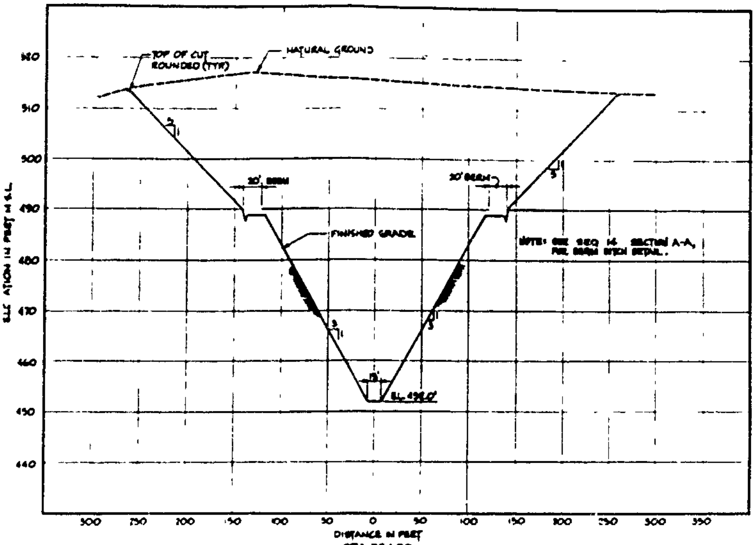






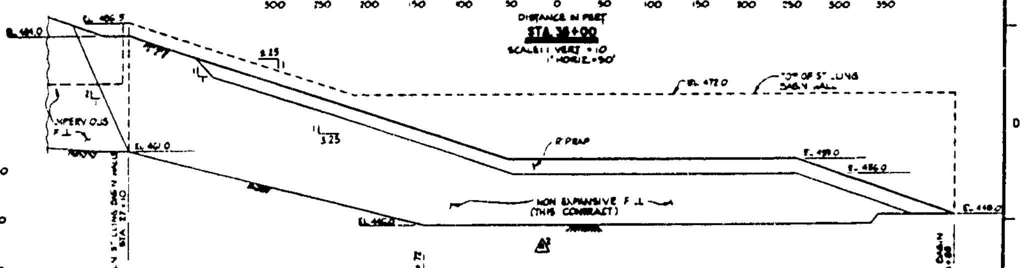
PROFILE OF FILL BEHIN[D]
APPROACH WALLS
SCALE: 1 INCH = 10 FEET





STA 36+00

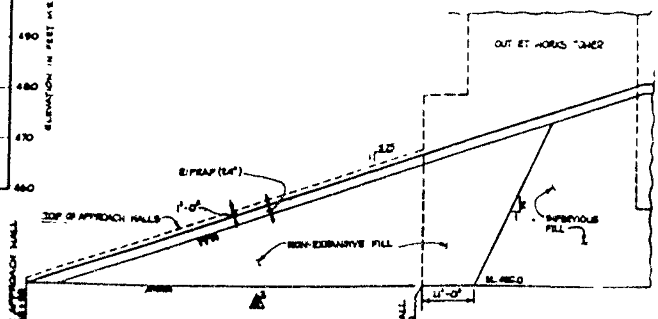
SCALE: 1" VERT = 10'
1" HORIZ = 50'



PROFILE OF FILL BEHIND STILLING BASIN WALLS

SCALE: 1 INCH = 10 FEET

NOTES:
1. FOR EXCAVATION PLAN, SEE SEQ 14
2. FOR GRADING PLAN, SEE SEQ 16
3. FOR OUTLET WORKS EXCAVATION AND BACKFILL STAGING, SEE SEQ 17
4. FOR DIMENSIONS ALONG STILLING BASIN WALL BASE, SEE SEQ 17



PROFILE OF FILL BEHIND APPROACH WALLS

SCALE: 1 INCH = 10 FEET

GENERAL REVISIONS

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

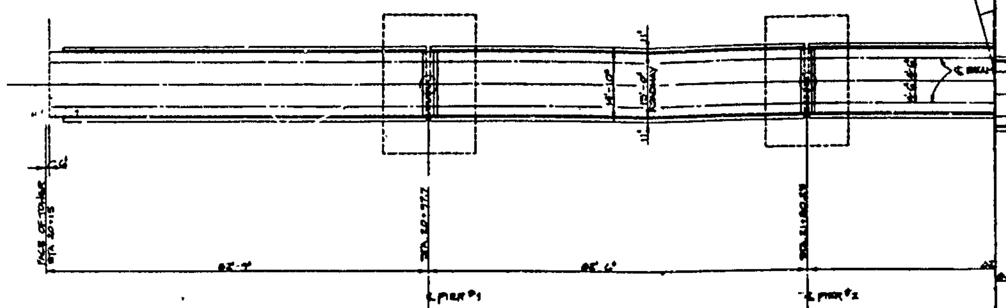
OUTLET WORKS

STILLING BASIN AND DISCHARGE CHANNEL
SECTIONS AND PROFILES

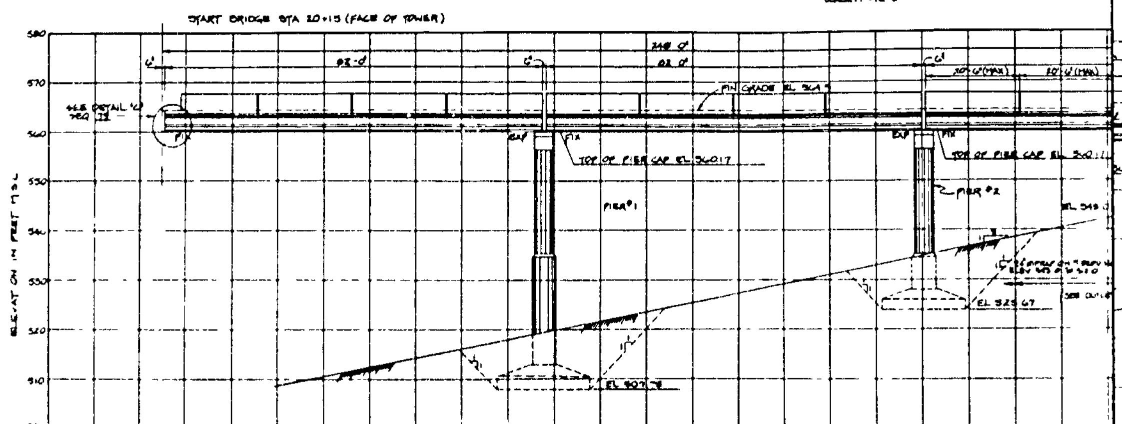
DACW63-79-B-0115
DATED SEPT. 1979

16

PLATE 9



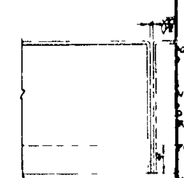
PLAN
SCALE 1" = 10' 0"



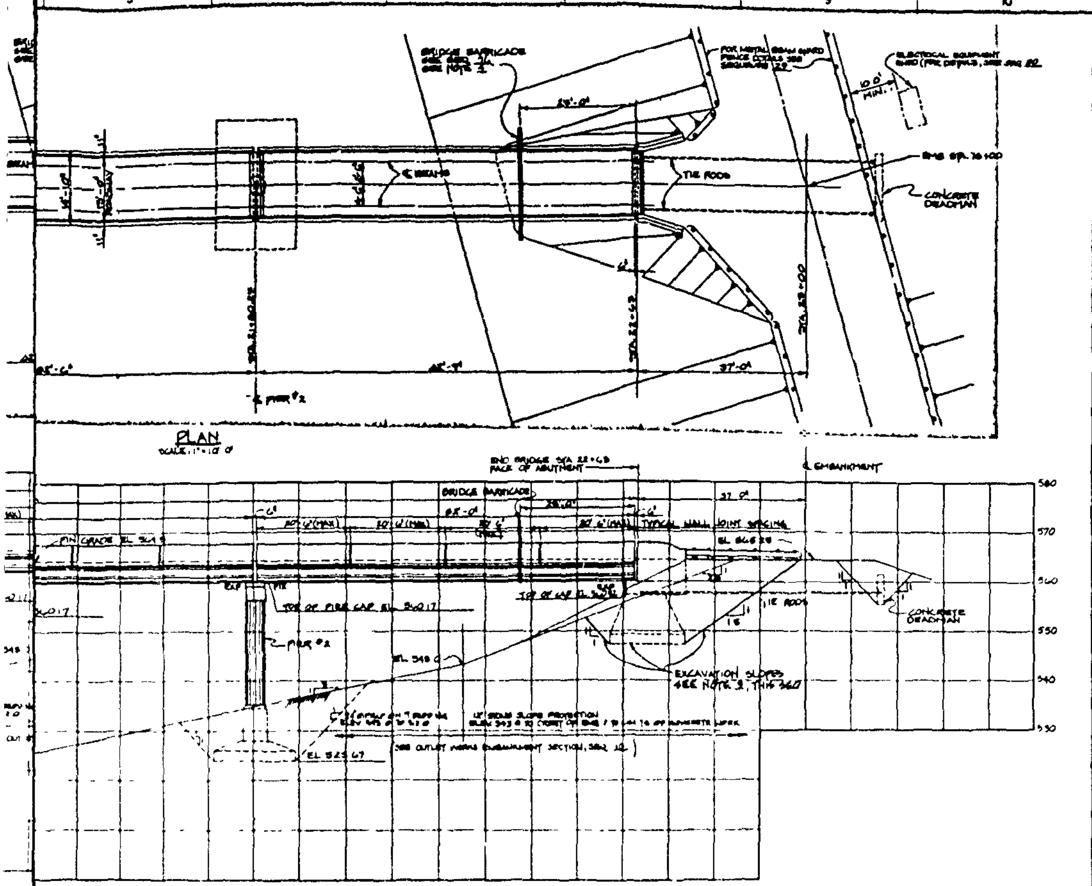
PROFILE
SCALE 1" = 10' 0"

SERVICE BRIDGE NOTES

1. BRIDGE DESIGNED ACCORDING TO THE DEPARTMENT OF ARMY ENGINEERING MANUAL FOR CIVIL WORKS AND 1977 AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES
2. DESIGN LIVE LOAD IS A H 15 44 AASHTO STANDARD TRUCK. MAXIMUM DESIGN WIND VELOCITY IS 100 MPH
3. THE BRIDGE ABUTMENT AND 'DEADMAN' PIERS #1 AND #2 SHALL NOT BE CONSTRUCTED UNTIL THE EMBANKMENT HAS BEEN CONSTRUCTED TO TEMPLATE GRADE THE COST OF ALL STRUCTURAL EXCAVATION AND STRUCTURAL BACKFILL WITHIN THAT EXCAVATION IS TO BE INCLUDED IN THE JOB SUM PRICE BID FOR THE SERVICE BRIDGE. RE BACKFILL AFTER CONSTRUCTION OF ABUTMENT SHALL BE TO THE FINISHED GRADES AND LINES AS SHOWN IN THE PLAN AND PROFILE VIEWS OF THIS SEQUENCE
4. CONCRETE FOR PIERS, ABUTMENT AND DEADMAN SHALL BE HARDROCK CONCRETE WITH A 28 DAY COMPRESSIVE STRENGTH OF 4000 PSI. CONCRETE FOR THE BRIDGE DECKS AND PARAPETS SHALL BE LIGHTWEIGHT CONCRETE WITH A MAX AIR DRY WEIGHT OF 110 PCF AND A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI
5. CHAMFER ALL EXPOSED CONCRETE CORNERS ¾" UNLESS OTHERWISE NOTED
6. ALL EXPOSED BUFF COLORED CONCRETE SHALL RECEIVE A CLASS 'A' FINISH WHICH SHALL EXTEND ABOVE 1' 0" BELOW TOP OF FINISHED GRADE OR FUTURE BACKFILL
7. METAL FORMS ARE REQUIRED FOR ALL CIRCULAR COLUMNS BEGINNING 1' 0" BELOW FINISHED GRADE AND ABOVE
8. REINFORCING STEEL SHALL BE ASTM A615 GRADE 60
9. ALL SPIRAL REINFORCING SHALL BE SMOOTH BARS
10. ALL WELDING SHALL BE IN ACCORDANCE TO AWS D1.1
11. ALL STRUCTURAL STEEL RODS PLATES AND SHAPES SHALL BE OF ASTM A36 MAT'L UNLESS OTHERWISE SHOWN
12. ALL CONCRETE SURFACES ONE FOOT OR MORE BELOW FINISH GRADE OR BACKFILL AND FORMED CONSTRUCTION JOINTS SHALL HAVE A CLASS 'D' FINISH
13. BUFF COLORED CEMENT SHALL BE USED IN THE BRIDGE SLABS PRESTRESSED GIRDERS AND ABOVE ONE (1) FOOT BELOW TOP OF FINISH GRADE OR FUTURE BACKFILL FOR PIERS 1 & 2 AND THE ABUTMENT. STD GREY CEMENT SHALL BE USED BELOW THE ONE FOOT BELOW FINISH GRADE LEVEL FOR THE PIERS AND ABUTMENT AND ALSO FOR THE DEADMAN
14. THE FINAL APPEARANCE COAT OF PAINT OF THE BARRICADE AND MISC EXPOSED METALS SHALL BE BROWN IN COLOR, CONFORMING TO FED STD NO 595 20099
15. THE CONTRACTOR SHALL INFORM THE CONTRACTING OFFICER PRIOR TO SETTING THE BRIDGE ELASTOMERIC BEARING PADS AND THE BRIDGE GIRDERS
16. THE CONTRACTOR SHALL EXERCISE UTMOST CAUTION TO CAUSE THE ABUTMENT AND PIERS TO BE LOCATED AT THE EXACT STATIONS AND ELEVATIONS INDICATED ON THE 'PLANS' AND 'ELEVATIONS' ON THIS SHEET AND PROPERLY ORIENTED TO THE CENTERLINE OF THE BRIDGE
17. THE CONTRACTOR SHALL PROVIDE INSERTS IN THE PRE STRESSED CONCRETE GIRDER TO PROVIDE FOR ATTACHMENT OF BRIDGE BARRICADE (SEE SEQ 3L) AND FOR BRACING OF TANK AND PIPE SUPPORTS (SEE SEQ 3L)
18. FOR GENERAL NOTES SEE SEQ 3A



INTERMEDIATE HAL[L]
SCALE ¾"



PROFILE

...OOT OR MORE BELOW FINISH
... CONSTRUCTION JOINTS SHALL

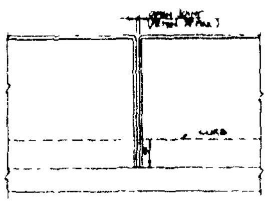
... USED IN THE BRIDGE SLABS
...VE ONE (1) FOOT BELOW TOP OF
... FOR PIERS 1, 2 AND THE ABUTMENT
... BELOW THE ONE FOOT BELOW
...RS AND ABUTMENT AND ALSO FOR

...AINT OF THE BARRICADE AND
... BROWN IN COLOR, CONFORMING TO

...HE CONTRACTING OFFICER PRIOR
...BRIC BEARING PADS AND THE

... UTMOST CAUTION TO CAUSE THE
...CATED AT THE EXACT STATIONS
...THE PLANS AND ELEVATIONS
...ENTED TO THE CENTERLINE OF

...BEDDED IN THE PRE STRESSED
...R ATTACHMENT OF BRIDGE
... FOR BRACING OF TANK AND PIPE



INTERMEDIATE WALL JOINT DETAIL

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

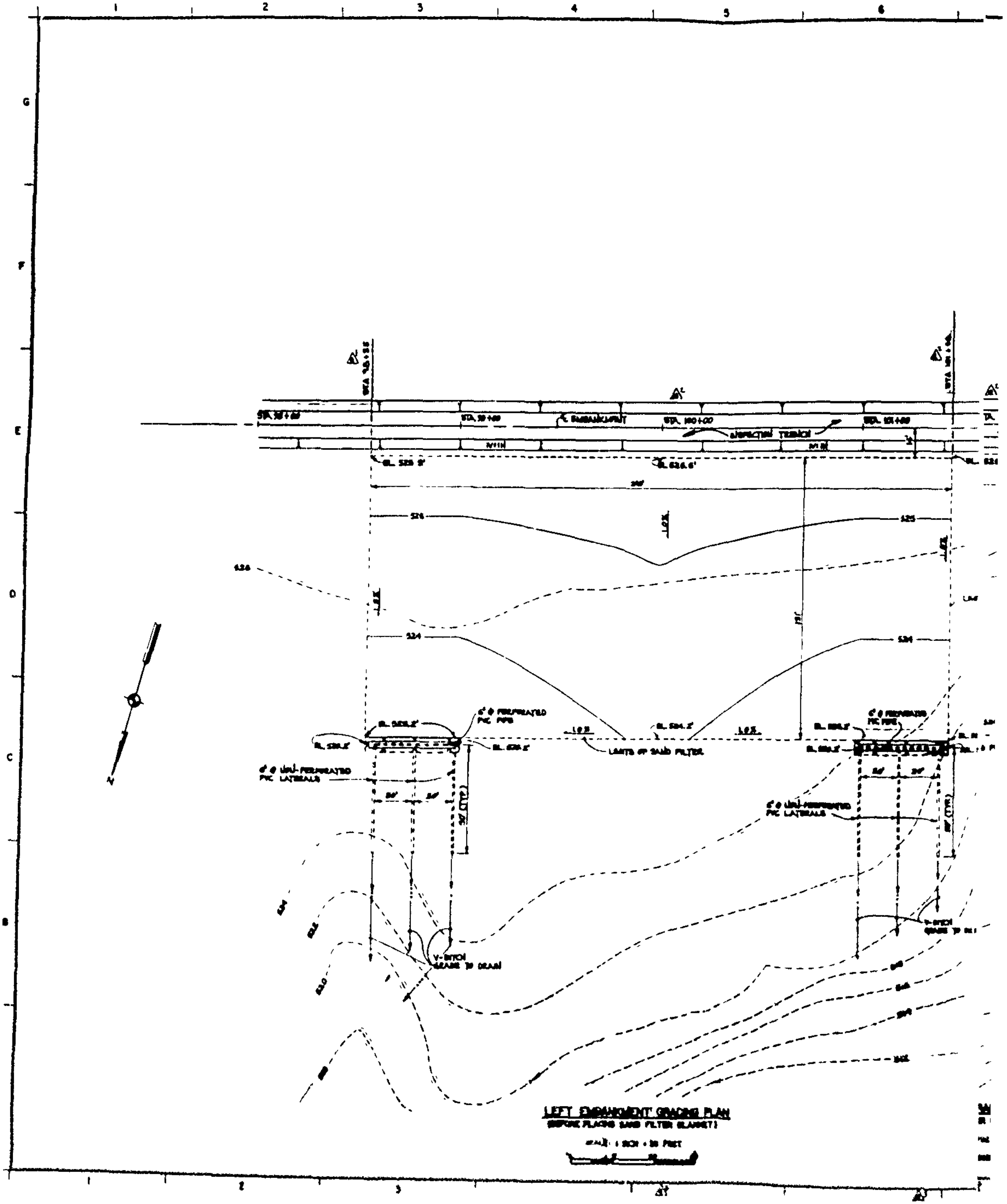
OUTLET WORKS SERVICE BRIDGE

PLAN & PROFILE

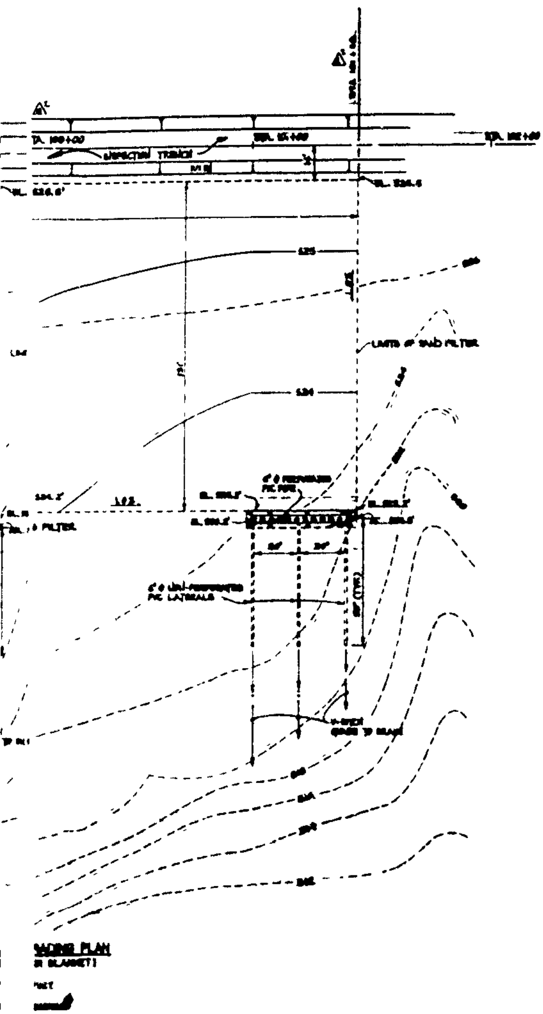
DATED JULY 1981

69

PLATE 10



LEFT EMBANKMENT GRADING PLAN
(BEFORE PLACING SAND FILTER BLANKET)



NOTES:

1. DASHED CONTOUR LINES REFLECT NATURAL GROUND BEFORE STRIPPING
2. FOR FINAL GRADING PLAN SEE SEQ 9

	REVISED LIMITS OF INSPECT TRENCH

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

LEFT EMBANKMENT

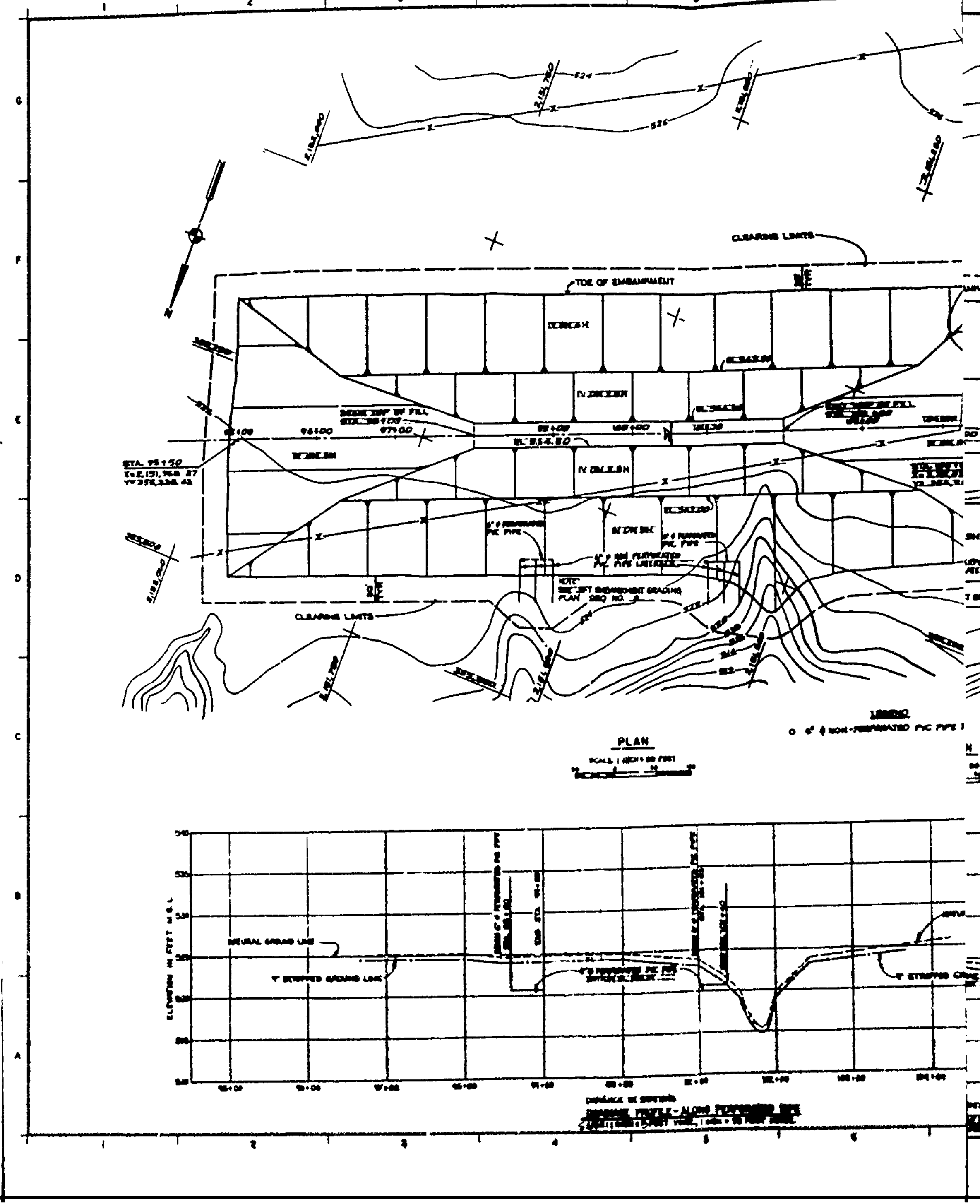
GRADING PLAN

TVS/RSA
TH
TVS/RSA

DACW63-79-B-0113
SEPT, 1979

8

PLATE 11



CLEARING LIMITS
TOE OF EMBANKMENT
STA. 95+50
CLEARING LIMITS
LEGEND
PLAN
NATURAL GROUND LINE
ELEVATION IN FEET M.S.L.
DISTANCE IN STATIONS

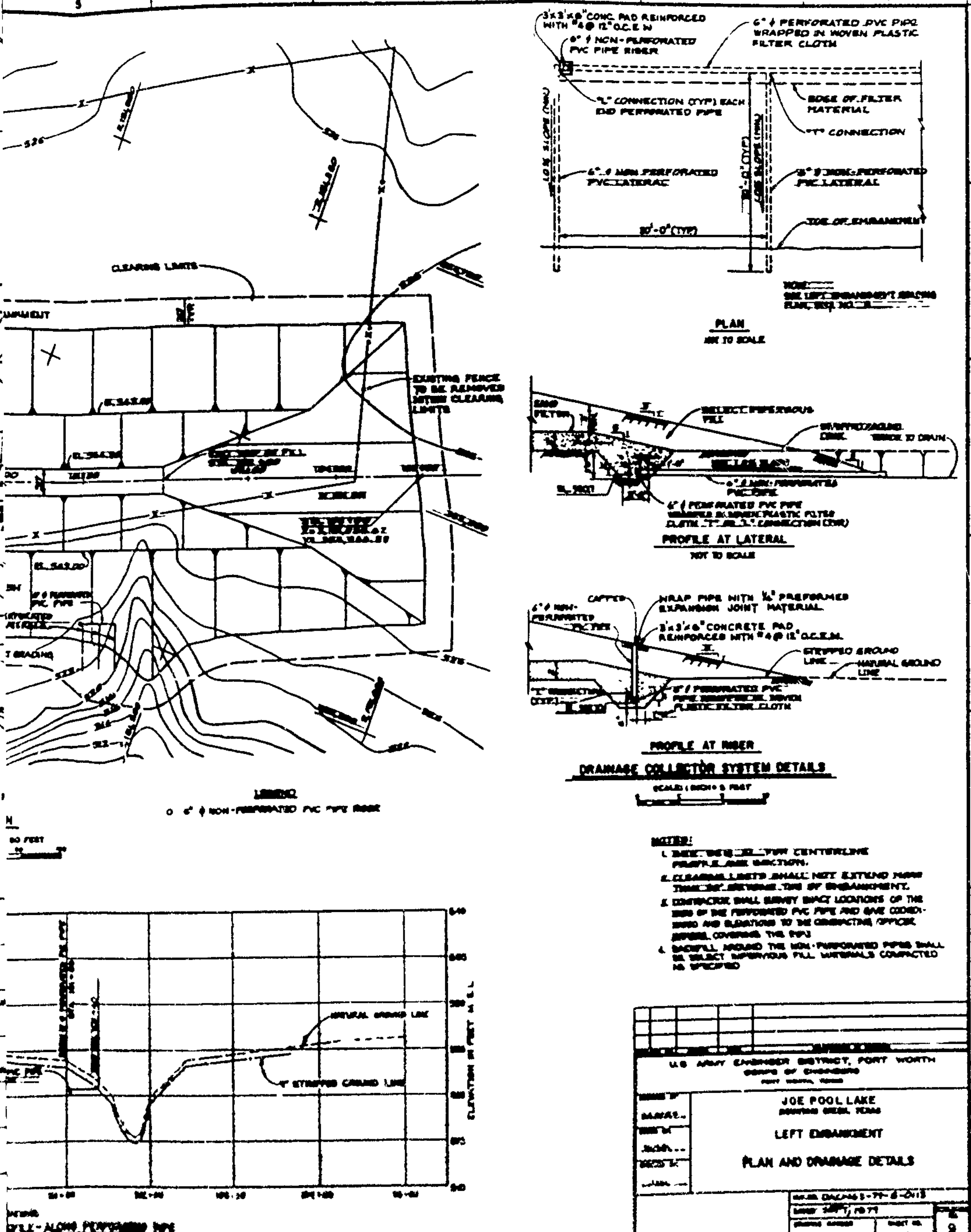
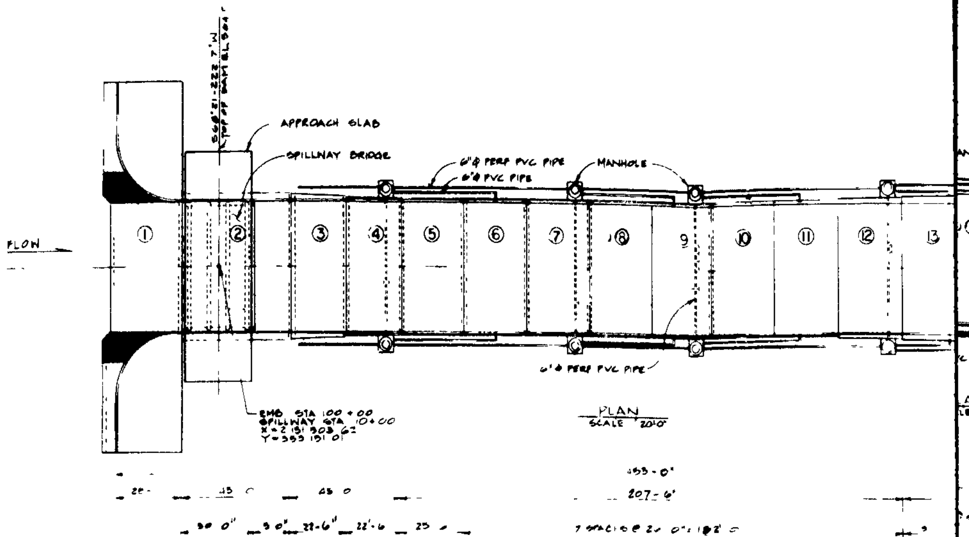
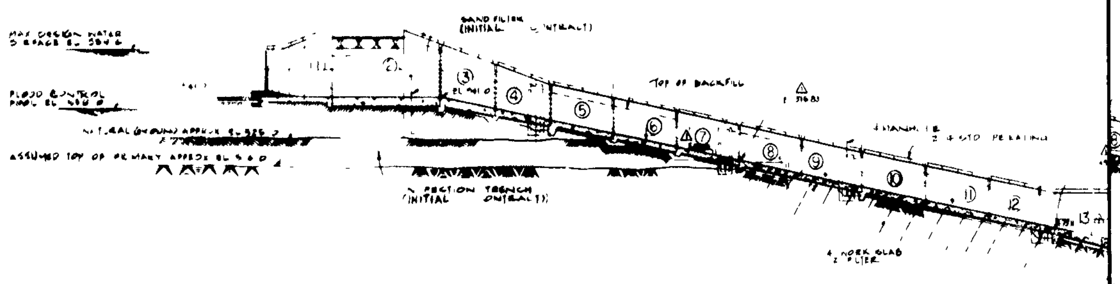

3'x3'x6" CONC. PAD REINFORCED WITH #4 @ 12" O.C.E.W.
6" ϕ NON-PERFORATED PVC PIPE RISER
6" ϕ PERFORATED PVC PIPE WRAPPED IN WOVEN PLASTIC FILTER CLOTH
"L" CONNECTION (TYP) EACH END PERFORATED PIPE
EDGE OF FILTER MATERIAL
"T" CONNECTION
6" ϕ NON-PERFORATED PVC LATERAL
TOE OF EMBANKMENT
30'-0" (TYP)
PLAN
NOT TO SCALE
CLEARING LIMITS
EXISTING FENCE TO BE REMOVED WITHIN CLEARING LIMITS
PROFILE AT LATERAL
NOT TO SCALE
CAPPED
WRAP PIPE WITH ½" PREFORMED EXPANSION JOINT MATERIAL
3'x3'x6" CONCRETE PAD REINFORCED WITH #4 @ 12" O.C.E.W.
STRIPPED GROUND LINE
NATURAL GROUND LINE
PROFILE AT RISER
DRAINAGE COLLECTOR SYSTEM DETAILS
LEGEND
o 6" ϕ NON-PERFORATED PVC PIPE RISER
NATURAL GROUND LINE
STRIPPED GROUND LINE
ELEVATION IN FEET M.S.L.
NOTES:
4. BACKFILL AROUND THE NON-PERFORATED PIPES SHALL BE SELECT IMPERVIOUS FILL MATERIALS COMPACTED AS SPECIFIED
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
JOE POOL LAKE
LEFT EMBANKMENT
PLAN AND DRAINAGE DETAILS
9

PLATE 12



PLAN
SCALE 20'-0"



SECTIONAL ELEVATION ℄
SCALE 20'0"

GENERAL NOTES

ALL CONCRETE SURFACES SHALL BE FINISHED IN ACCORDANCE WITH THE REQUIREMENTS OF THE SPECIFICATIONS AND AS OUTLINED BELOW

A. ALL EXPOSED CONCRETE SURFACES SHALL HAVE A CLASS D FINISH UNLESS OTHERWISE NOTED

B. [illegible] FINISH GRADE OR TOP OF FUTURE [illegible]

C. ALL EXPOSED SURFACES OF THE BAFFLE BLOCKS SHALL BE CLASS C FINISH

D. ALL CONCRETE SURFACES ONE FOOT OR MORE BELOW FINISH GRADE OR BACKFILL, AND FORMED CONSTRUCTION AND CONTRACTION JOINTS SHALL BE CLASS D FINISH

E. ALL UNFORMED SURFACES EXCEPT CONSTRUCTION JOINTS SHALL HAVE A [illegible] FINISH AS INDICATED IN THE SPECIFICATIONS

2. ALL CONTRACTION AND CONSTRUCTION JOINTS AND EXPOSED EDGES SHALL BE CHAMFERED 3/4" UNLESS OTHERWISE SHOWN [illegible]

3. [illegible] SHALL HAVE TOOLED EDGES UNLESS OTHERWISE SHOWN OR NOTED [illegible]

4. ALL CONTRACTION JOINTS SHALL BE TREATED WITH MEMBRANE CURING COMPOUND TO PREVENT SURFACES FROM BONDING

5. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS UNLESS OTHERWISE NOTED

6. REINFORCING

A. REINFORCING BARS SHALL NOT EXTEND THROUGH CONTRACTION JOINTS

B. REINFORCING STEEL SHALL BE ASTM A615 GRADE 60

C. REINFORCING FOR THE SPILLWAY ANCHORS WILL BE ASTM [illegible]

D. UNLESS OTHERWISE NOTED LAP SPLICE OR EMBEDMENT LENGTHS SHALL [illegible] TABLE ON THIS SHEET

E. ALL REINFORCING BARS [illegible] EXPANSION JOINTS AND NONE SHALL PASS THROUGH THE [illegible] WHICH SHALL BE AS NOTED

F. ALL PRIMARY REINFORCING SHALL HAVE A MINIMUM [illegible] UNLESS OTHERWISE NOTED

7. [illegible] ON THE VERTICAL OR NEAR VERTICAL SURFACES IN SHALE SHALL BE [illegible] OVER EXCAVATION SHALL BE [illegible] AREA AND [illegible] CONTRACT

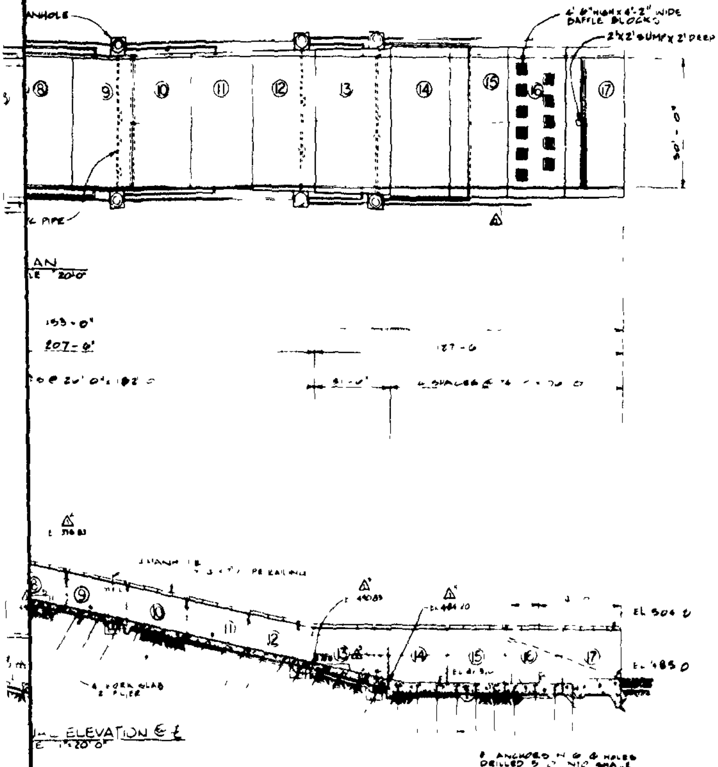
8. [illegible] SHOWN

9. [illegible] SEE SEQ 57

[illegible]

FOR DETAILS OF WATERSTOPS [illegible] AND HANDRAILS SEE SEQ [illegible]

[illegible] LOCATIONS [illegible]



CLASS "C" TENSION LAP BAR AND EMBEDMENT						
f_c	f_y	BAR SIZE	LAP LENGTH (INCH)		EMBEDMENT LENGTH (INCH)	
			OTHER BAR	TOP BAR	OTHER BAR	TOP BAR
3,000 Psi	60,000 Psi	3	12	7	12	2
		4	16	24	12	14
		5	[illegible]	29	12	7
		6	27	37	16	22
		7	36	51	21	30
		8	46	66	28	40
		9	61	80	36	49
		10	76	106	45	63
		11	93	131	55	77

* TOP BARS ARE HORIZONTAL REINFORCEMENT SO PLACED THAT MORE THAN 12" OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR
* LAP LENGTHS SHOWN ARE FOR CLASS "C" SPLICES. LAP LENGTHS AND EMBEDMENTS SHOWN ARE FOR BARS SPACED LATERALLY ≥ 6" AND ≥ 3" FROM THE SIDE FACE IN ACCORDANCE WITH A.C.I. 318-77

NOTES:
FOR CLARIFICATION OF EMBEDMENT AND LAP LENGTH SEE SEQ 54

...S SHALL NOT EXTEND THROUGH CONTRACTION JOINTS
...STEEL SHALL BE A.S.T.M. A 615 GRADE 60
...OR THE SPILLWAY ANCHORS WILL BE A.S.T.M. A 615 GRADE 60
...UNLESS NOTED LAP SPLICE OR EMBEDMENT LENGTHS SHALL CONFORM ...
...BARS SHALL ... AND NONE SHALL PASS THROUGH THE JOINTS, EXCEPT ... SHALL BE AS NOTED
...SHALL HAVE A MINIMUM ... CLEAR ... EXCEPT AS NOTED
...VERTICAL OR NEAR VERTICAL SURFACES IN SHALE SHALL BE PERFORMED ... OVEREXCAVATION SHALL BE BACKFILLED ... AREA AND AT ...
...UNLESS OTHERWISE SHOWN
... SEE SEQ 52
... SEE SEQ 42
... SEE SEQ 36
...LOCATIONS SEE SEQ 22 ... SEE SEQ 21 & 24

2		PM	1 JUN 83	REVISED SLAB THICKNESS
1		AMD 0001	31 JUL 81	REVISIONS

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

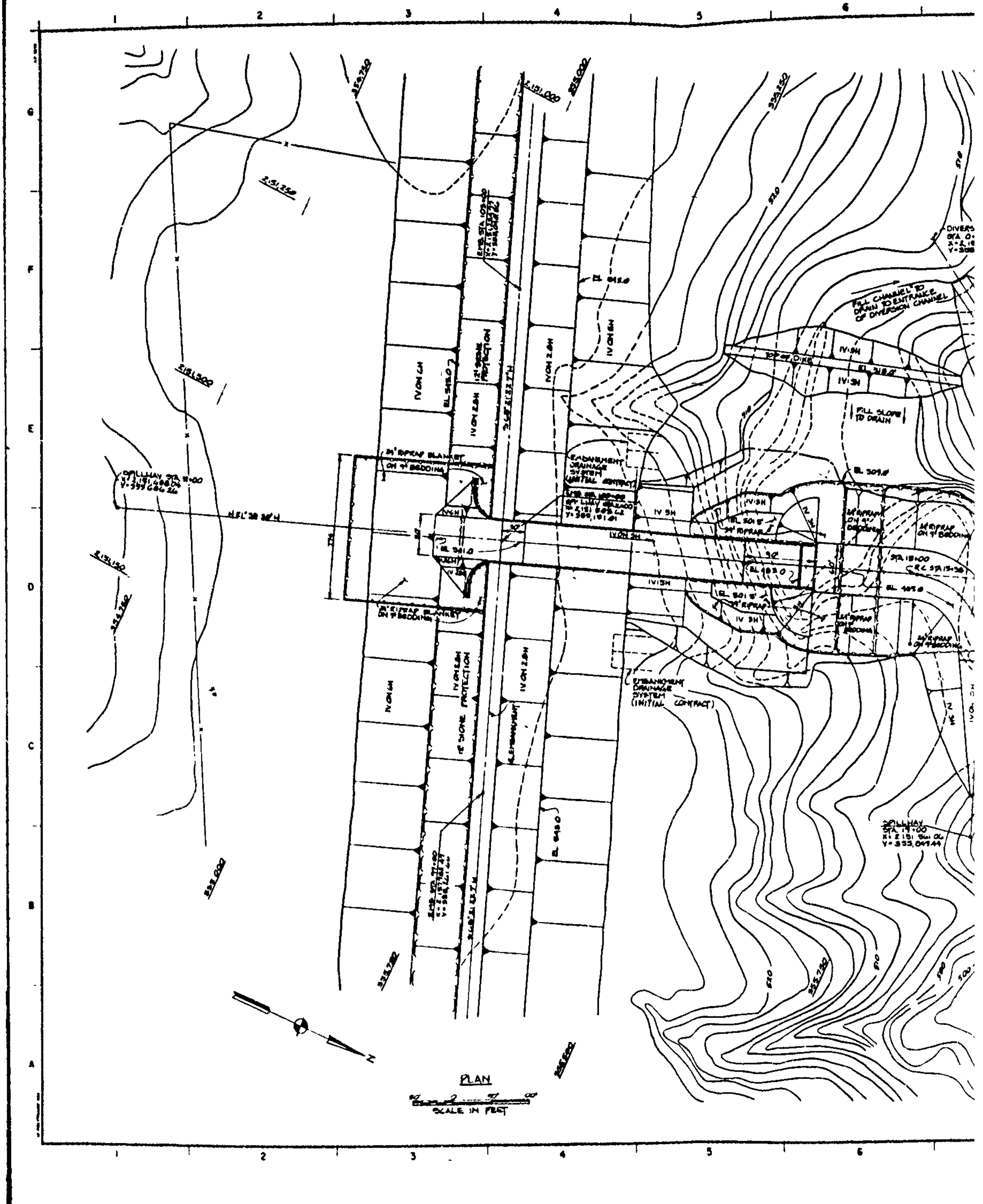
EMBANKMENT, SPILLWAY, AND OUTLET WORKS

SPILLWAY
PLAN & PROFILE

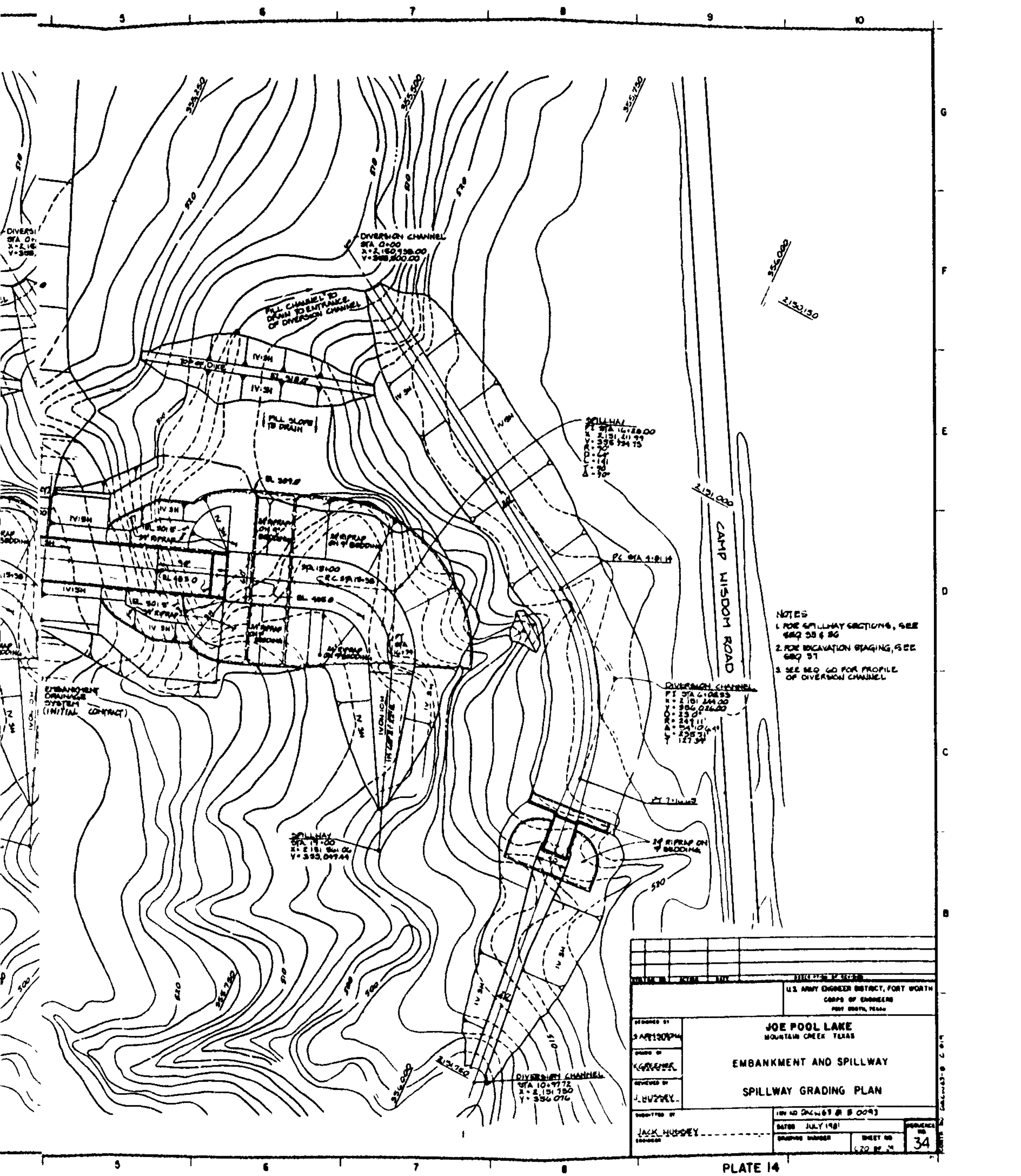
DESIGNED BY: D. BRITT, N. SHAVER
DRAWN BY: S. HORACK
REVIEWED BY: H. JAVER

INV NO DACW63 R ... 2093
DATED JULY 1981
SHEET NO. 38

PLATE 13

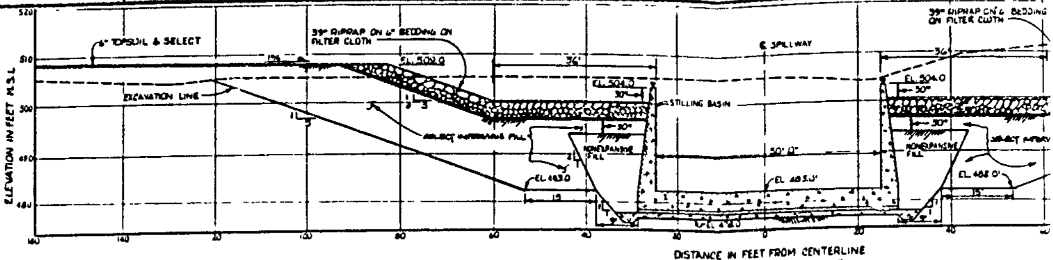


EMBANKMENT DRAINAGE SYSTEM (INITIAL CONTRACT)
FILL CHANNEL TO DRAIN TO ENTRANCE OF DIVERSION CHANNEL
TOP OF DIKE
FILL SLOPE TO DRAIN
12" STONE PROTECTION
IV ON 2.8H
IV ON 3H
EL 509.0
EL 501.0
EL 541.0
IV:3H
SPILLWAY STA 19+00
PLAN
SCALE IN FEET

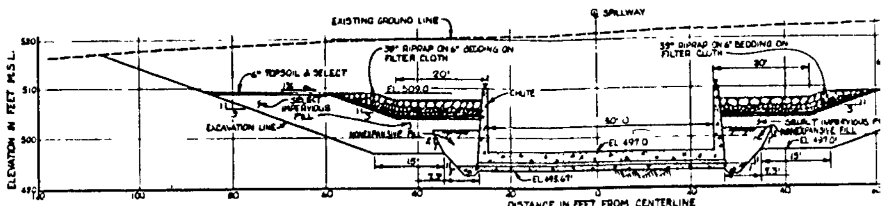


DIVERSION CHANNEL
STA 0+00
X=2,150,938.00
Y=355,500.00
FILL CHANNEL TO DRAIN TO ENTRANCE OF DIVERSION CHANNEL
TOP OF DIKE
FILL SLOPE TO DRAIN
CAMP WISDOM ROAD
NOTES
1. FOR SPILLWAY SECTIONS, SEE SEQ 55 & 56
2. FOR EXCAVATION STAGING, SEE SEQ 57
3. SEE SEQ 60 FOR PROFILE OF DIVERSION CHANNEL
EMBANKMENT DRAINAGE SYSTEM (INITIAL CONTRACT)
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT AND SPILLWAY
SPILLWAY GRADING PLAN
DATED JULY 1981
34

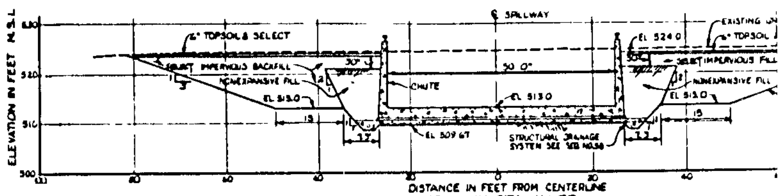
PLATE 14



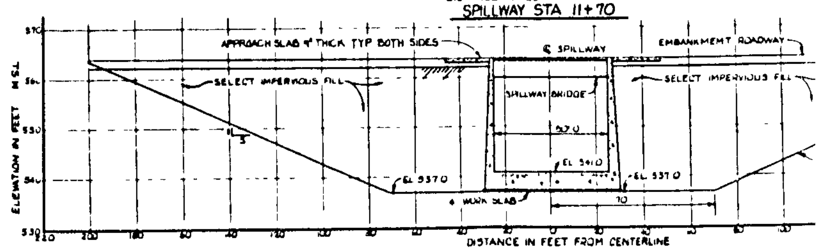
SPILLWAY STA 13+60



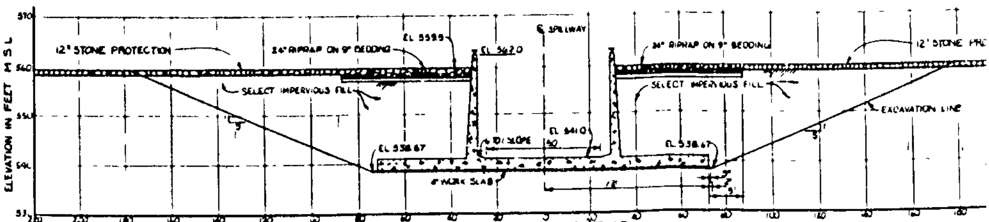
SPILLWAY STA 12+50



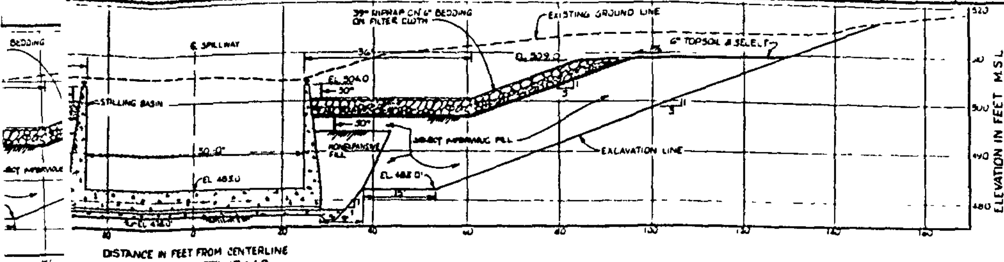
SPILLWAY STA 11+70



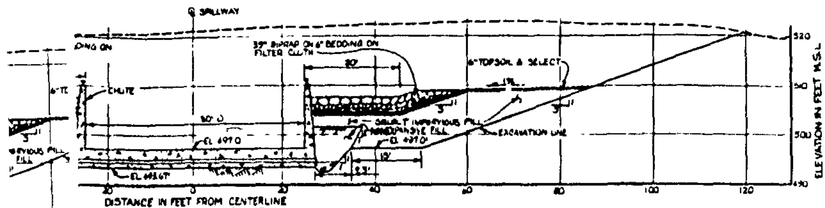
SPILLWAY STA 10+00



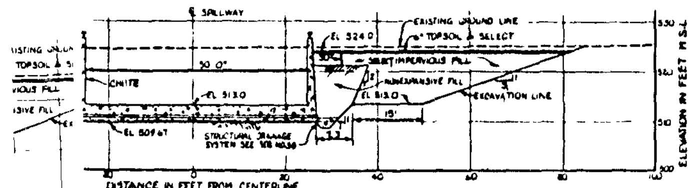
SPILLWAY STA 9+70



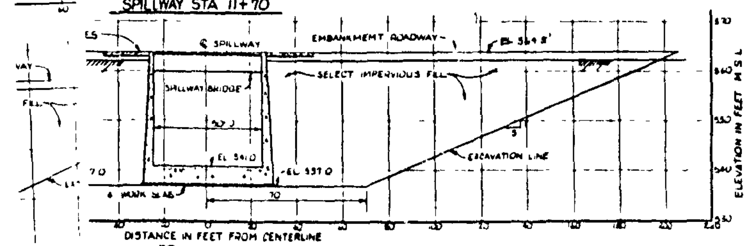
SPILLWAY STA 13+60



SPILLWAY STA 12+50



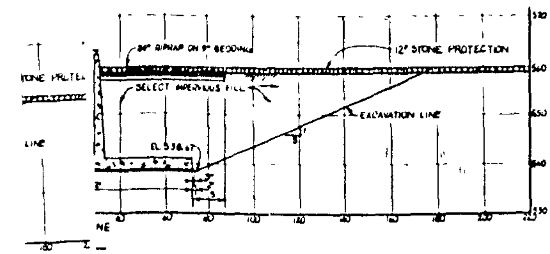
SPILLWAY STA 11+70



SPILLWAY STA 10+00

NOTES

1. SEE SEQ 34 FOR PLAN VIEW
2. STRUCTURAL DRAINAGE ARE SHOWN ON SEQ 38 THRU 39
3. PROFILE OF BACKFILL JUST BEHIND THE WALLS IS SHOWN ON SEQ 36
4. FOR TYPICAL SECTIONS, SEE SEQ 32
5. SPILLWAY EXCAVATION PLAN IS SHOWN ON SEQ 33



U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY R. SANCHEZ
DRAWN BY J. NELMS
REVIEWED BY S. ARMSTRONG
SUBMITTED BY JACK HUSSEY

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

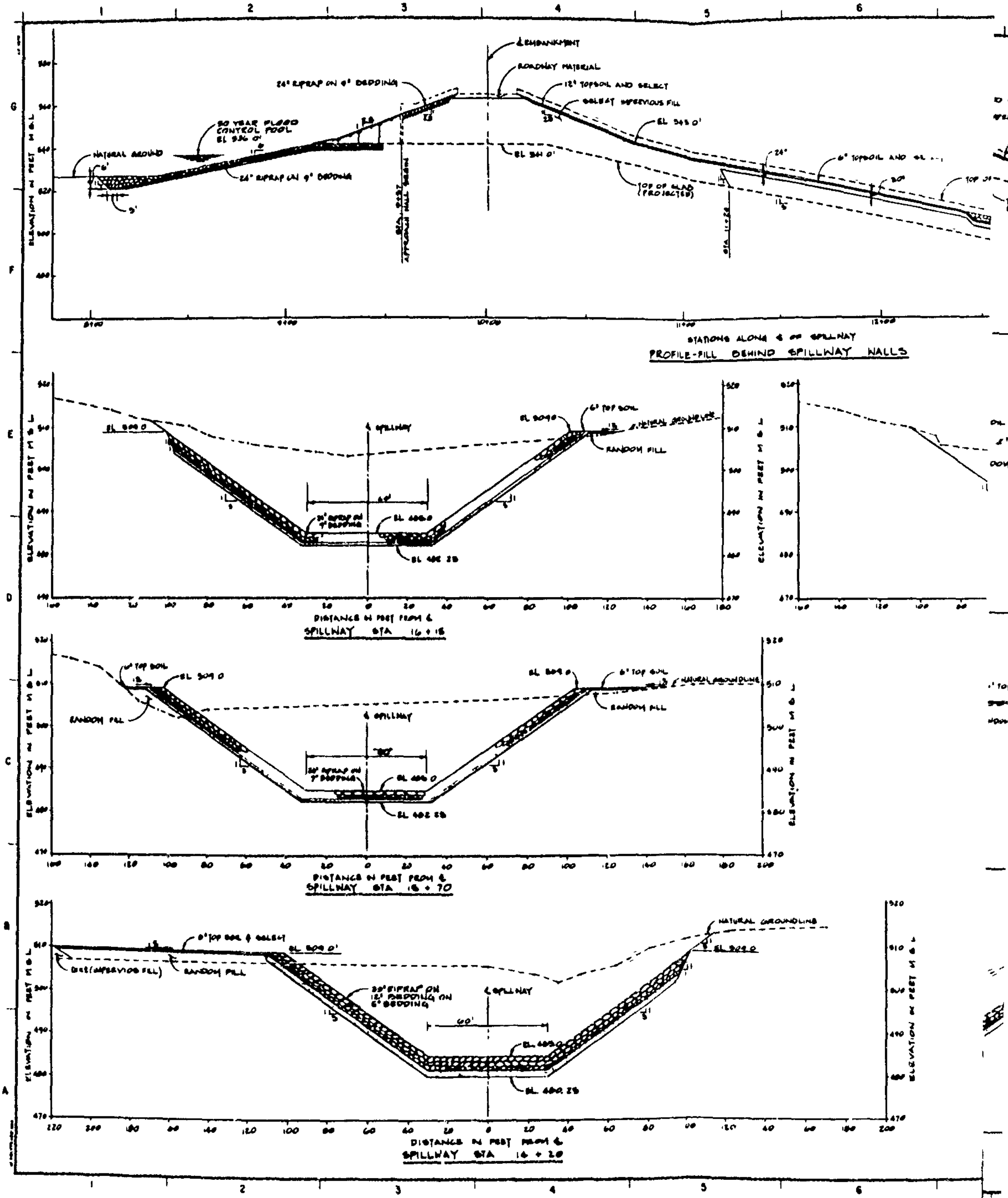
EMBANKMENT AND SPILLWAY

SPILLWAY SECTIONS-I
STATIONS 9+70-13+60

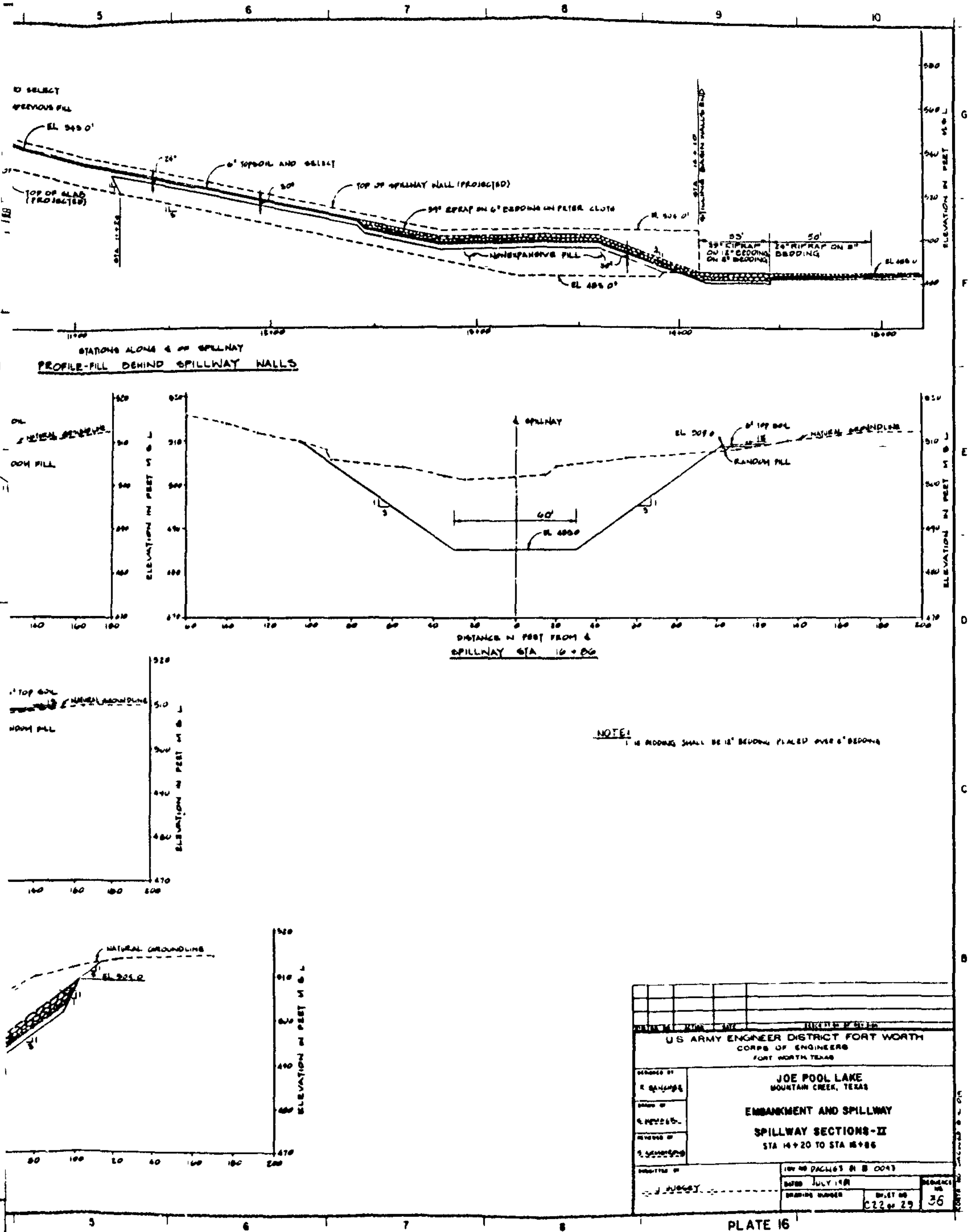
DATED JULY 481

SEQUENCE NO. 35

PLATE 15

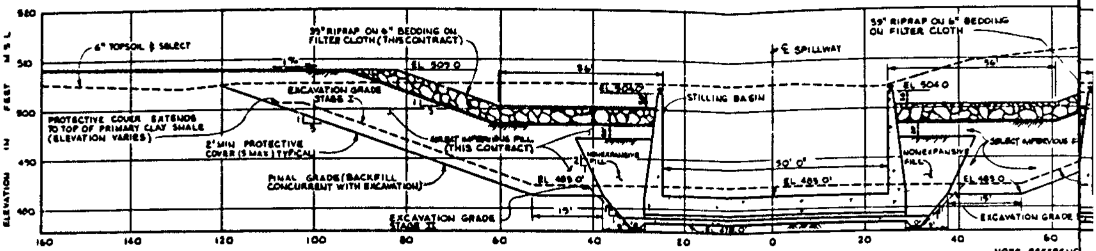


℄ EMBANKMENT
ROADWAY MATERIAL
24" RIPRAP ON 9" BEDDING
12" TOPSOIL AND SELECT
SELECT IMPERVIOUS FILL
50 YEAR FLOOD CONTROL POOL
NATURAL GROUND
24" RIPRAP ON 9" BEDDING
EL 545.0'
EL 541.0'
TOP OF SLAB (PROJECTED)
6" TOPSOIL AND SE...
ELEVATION IN FEET M.S.L.
STATIONS ALONG ℄ OF SPILLWAY
PROFILE-FILL BEHIND SPILLWAY WALLS
℄ SPILLWAY
EL 509.0
6" TOP SOIL
NATURAL GROUNDLINE
RANDOM FILL
EL 486.0
EL 485.25
DISTANCE IN FEET FROM ℄
SPILLWAY STA 16 + 15
6" TOP SOIL
EL 509.0
RANDOM FILL
EL 486.0
EL 485.25
DISTANCE IN FEET FROM ℄
SPILLWAY STA 16 + 70
NATURAL GROUNDLINE
6" TOP SOIL & SELECT
EL 509.0'
DIKE (IMPERVIOUS FILL)
RANDOM FILL
℄ SPILLWAY
60'
EL 480.25
DISTANCE IN FEET FROM ℄
SPILLWAY STA 16 + 20



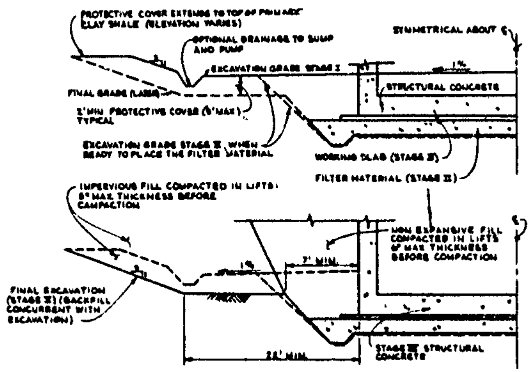
TOP OF SPILLWAY WALL (PROJECTED)
6" TOPSOIL AND SELECT
NONEXPANSIVE FILL
EL 485.0'
55'
50'
24" RIPRAP ON 9" BEDDING
STATIONS ALONG ℄ OF SPILLWAY
PROFILE-FILL BEHIND SPILLWAY WALLS
℄ SPILLWAY
NATURAL GROUNDLINE
RANDOM FILL
60'
ELEVATION IN FEET M S L
DISTANCE IN FEET FROM ℄
SPILLWAY STA 16+86
NOTE:
U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT AND SPILLWAY
SPILLWAY SECTIONS-II
STA 14+20 TO STA 16+86
36

PLATE 16



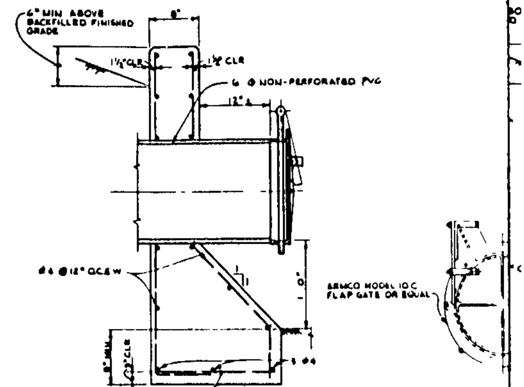
FOUNDATION EXCAVATION STAGING

(TYPICAL SECTION FOR SHALE)



SPILLWAY EXCAVATION & COMPACTED FILL STAGING

NOT TO SCALE

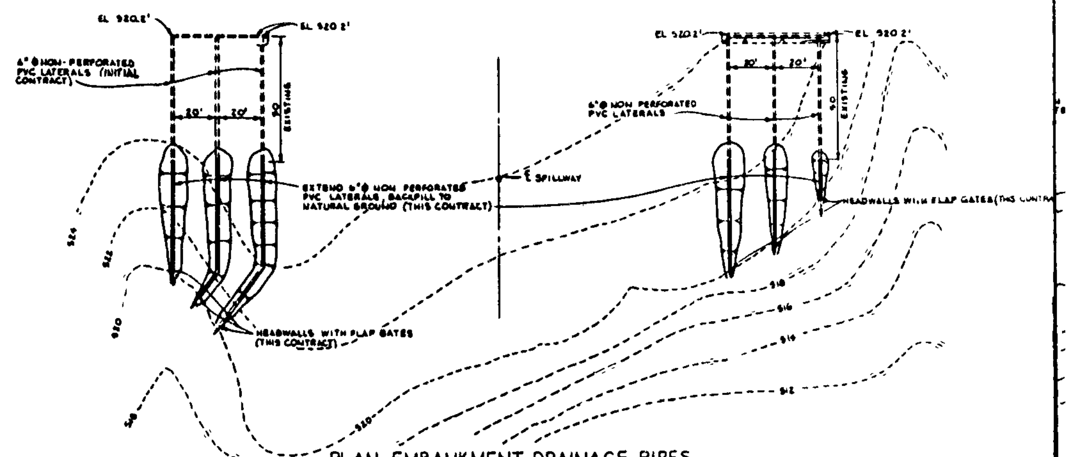


SECTION

FRONT EL

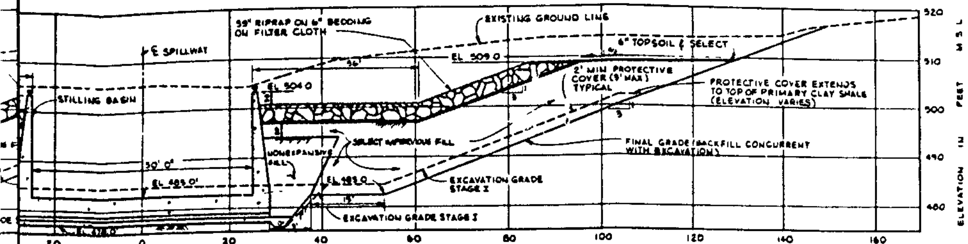
HEADWALL AND FLAP GATE DE

N T S



PLAN-EMBANKMENT DRAINAGE PIPES

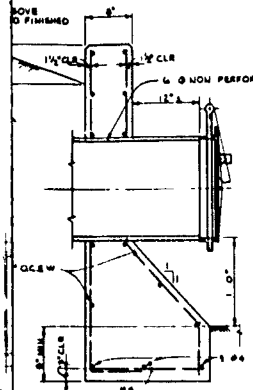
SCALE: 1 INCH = 20 FEET



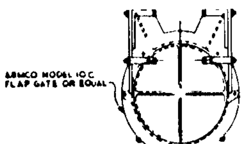
NOTE REFERENCE SECTION FOUNDATION EXCAVATION PROTECTION AND ANCHOR BARS OF THE CONTRACT SPECIFICATIONS

FOUNDATION EXCAVATION STAGING

(TYPICAL SECTION FOR SHALE)



SECTION



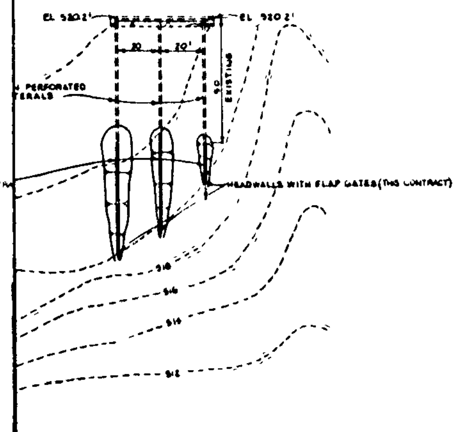
FRONT ELEVATION

HEADWALL AND FLAP GATE DETAIL

N T S

NOTES

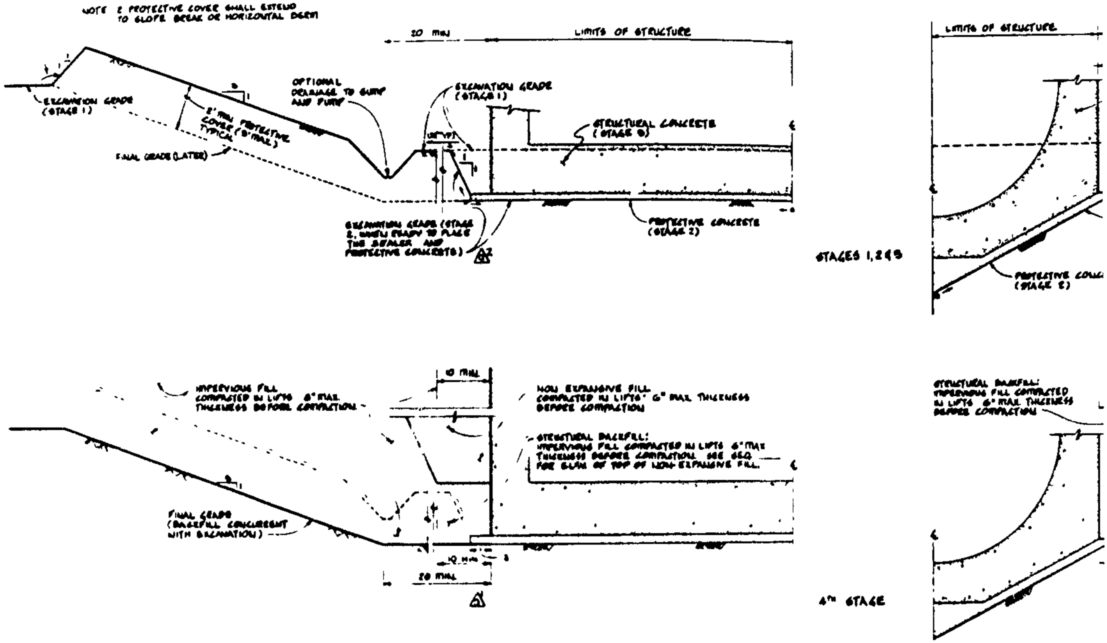
1. CONSTRUCTION EQUIPMENT EXCEPT THAT NEEDED FOR HAND POWER COMPACTION, WILL NOT BE PERMITTED WITHIN 5 FEET OF PVC UNTIL A MINIMUM OF 5 FEET OF HAND COMPACTED MATERIAL COVERS THE PVC
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 P S I AT 28 DAYS
3. THE CONCRETE HEADWALL SHALL EXTEND 1' BEYOND EACH SIDE OF THE BACKFILLED DITCH
4. THE LENGTH AND HEIGTH OF THE HEADWALL SHALL BE DETERMINED DURING CONSTRUCTION AND SHALL BE CONTROLLED BY THE WIDTH AND DEPTH OF THE BACKFILLED DITCH



PIPES

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY R SANCHES	JOE POOL LAKE MOUNTAIN CREEK TEXAS SPILLWAY EXCAVATION STAGING AND EXTENSION OF EMBANKMENT
DRAWN BY J. FISSSLER	
REVIEWED BY S. ARMSTRONG	
SUBMITTED BY JACE HUSSEY	INV NO DACW63 81-B 0093 DATED JULY 1981 DRAWING NUMBER SHEET NO 23 of 24 SEQUENCE NO 37

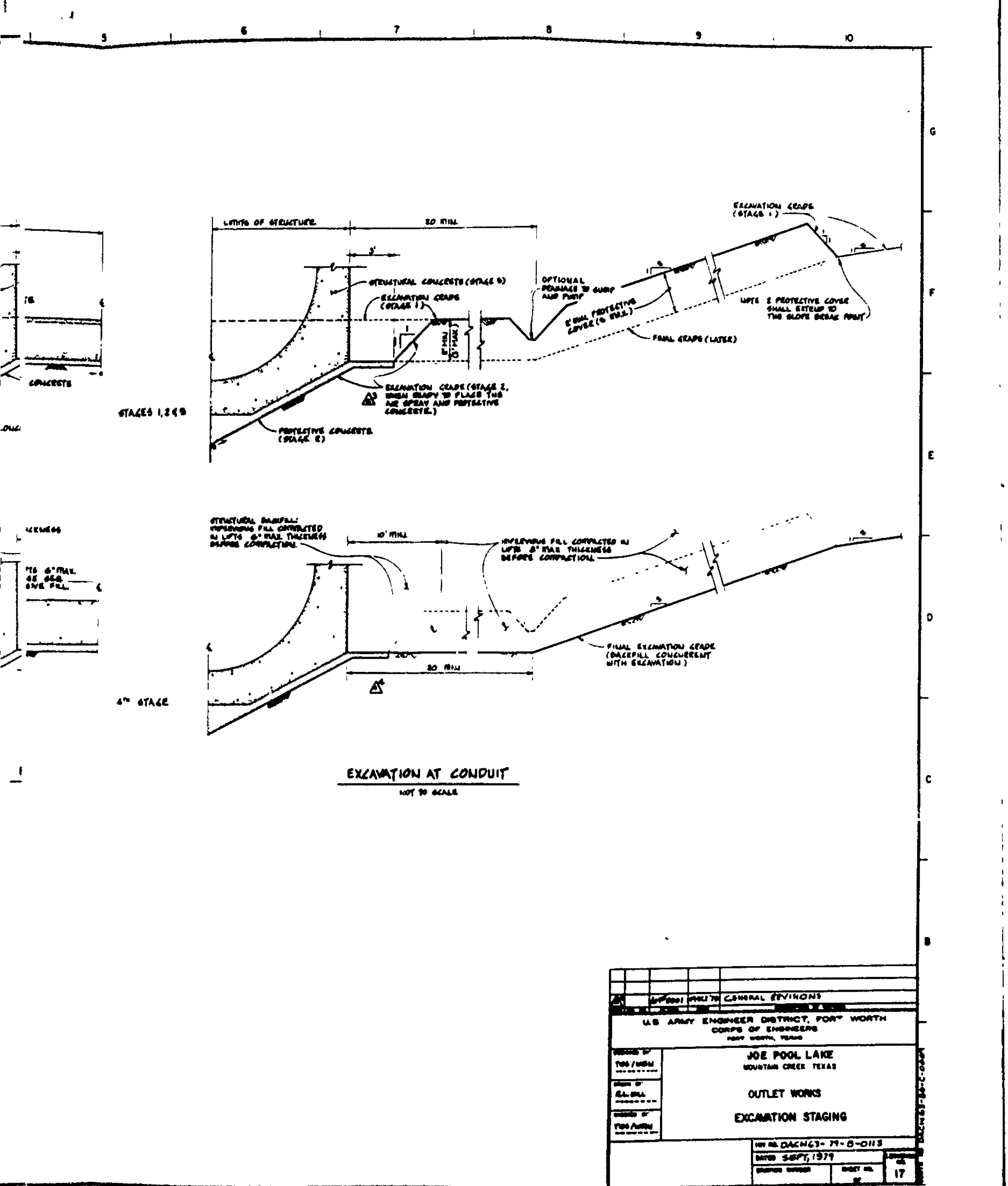


EXCAVATION AT APPROACH STRUCTURE

(STILLING BASIN SIMILAR)
NOT TO SCALE

NOTES

1. ALL SECTIONS SHOWN ARE SYMMETRICAL ABOUT CENTERLINE
2. ADDITIONAL BACKFILL STAGING REQUIREMENTS ARE PROVIDED IN PARAGRAPH 28-16 OF THE CONTRACT SPECIFICATIONS.
3. ADDITIONAL EXCAVATION RESTRAINTS FOR PROTECTION OF THE SHALE AND CLAY SHALE ARE PROVIDED IN SECTION 26 OF THE CONTRACT SPECIFICATIONS
4. STRUCTURAL BACKFILL INCLUDES, AS A MINIMUM, ALL NON-EXPANSIVE FILL AND/OR IMPERVIOUS FILL LOCATED WITHIN 10 FEET OF A CONCRETE STRUCTURE, MEASURED IN ANY DIRECTION INCLUDING VERTICALLY ABOVE A STRUCTURE.
5. USE THIS SEQ. 13 ONLY FOR STAGING OF EXCAVATION, PROTECTIVE CONCRETE AND BACKFILLING
6. THE SYMBOL "S" DENOTES THE LIMITS BETWEEN WHICH THE EXCAVATED SURFACE SHALL BE SPRAYED WITH A SEALER DESCRIBED IN THE SPECIFICATIONS. THESE LIMITS SHALL BE COMPLIED WITH.
7. IT IS RECOMMENDED THAT BACKFILL MATERIALS (EXCEPT NON-EXPANSIVE FILL) FOR CONFINED AREAS, SUCH AS THE LOWER PORTIONS OF THE OUTLET WORKS, BE PRE-WETTED OR DRIED-BACK TO A MOISTURE CONTENT NECESSARY TO ACHIEVE THE SPECIFIED IN-PLACE MOISTURE CONTENT. THIS WILL BOTH ENHANCE FOUNDATION PROTECTION AND ELIMINATE SOME PROBLEMS THAT PROCESSING THE MATERIALS IN CONFINED AREAS CAN CREATE.
8. SEE SEQ. 5, 15 & 16 FOR EXTENT OF BACKFILL BEHIND WALLS



LIMITS OF STRUCTURE
20 MIN.
STRUCTURAL CONCRETE (STAGE 3)
EXCAVATION GRADE (STAGE 1)
OPTIONAL DRAINAGE TO SUMP AND PUMP
FINAL GRADE (LATER)
EXCAVATION GRADE (STAGE 1)
PROTECTIVE CONCRETE (STAGE 2)
STAGES 1,2 & 3
10' MIN.
30 MIN.
FINAL EXCAVATION GRADE (BACKFILL CONCURRENT WITH EXCAVATION)
4TH STAGE
EXCAVATION AT CONDUIT
NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
JOE POOL LAKE
MOUNTAIN CREEK TEXAS
OUTLET WORKS
EXCAVATION STAGING
DACW63-79-B-0113
SEPT, 1979
17


CONSERVATION POOL EL
FLOOD CONTROL POOL
MIDLOTHIAN
CEDAR HILL
SCALE IN FEET
1
2
3
4
5
6
A
B
C
D
E
F
G

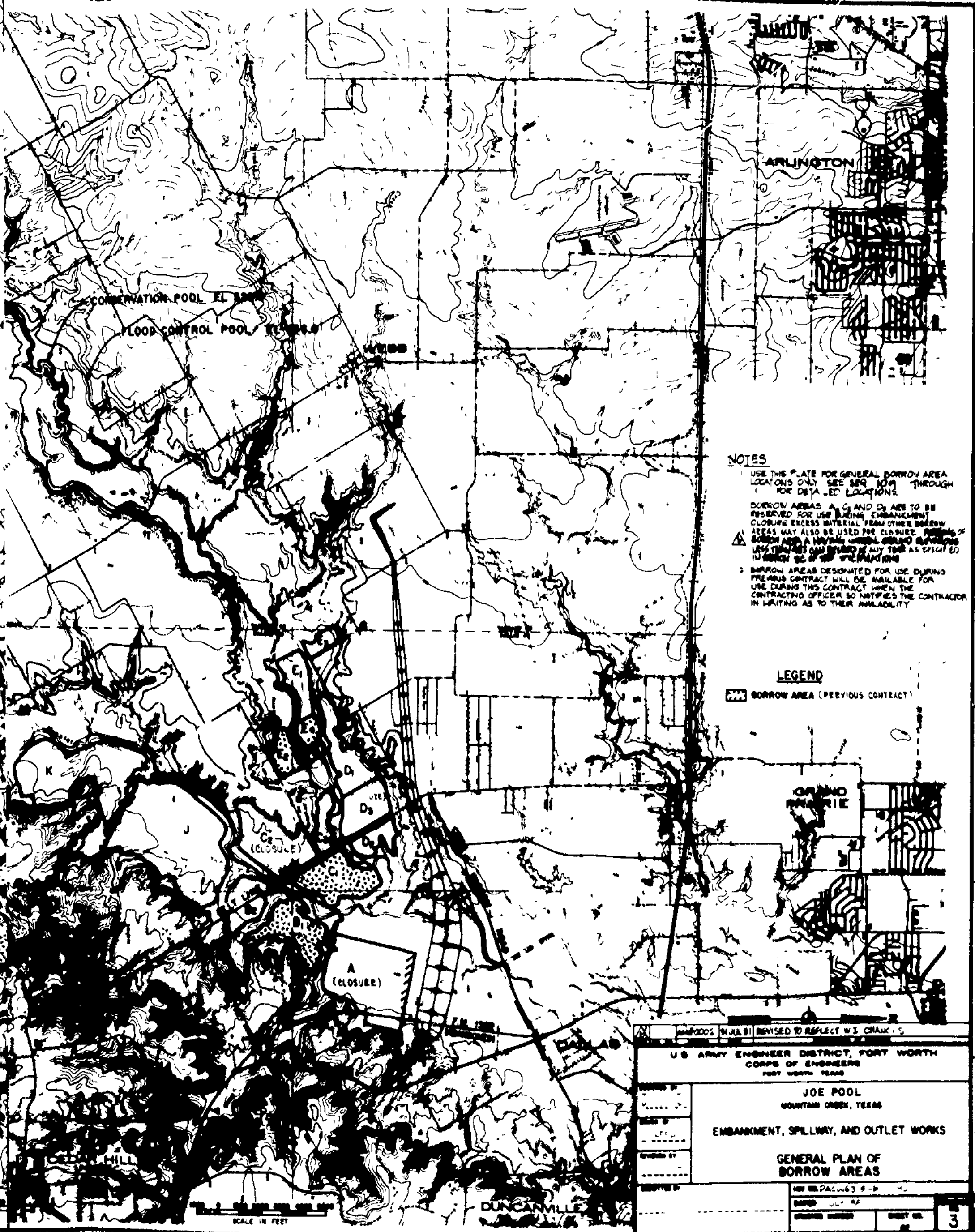

ARLINGTON
CONSERVATION POOL EL
FLOOD CONTROL POOL
GRAND PRAIRIE
CEDAR HILL
DUNCANVILLE
DALLAS
SCALE IN FEET
A (CLOSURE)
C₂ (CLOSURE)
NOTES
1 USE THIS PLATE FOR GENERAL BORROW AREA LOCATIONS ONLY SEE 109 THROUGH FOR DETAILED LOCATIONS.
BORROW AREAS A, C AND D ARE TO BE RESERVED FOR USE DURING EMBANKMENT CLOSURE EXCESS MATERIAL FROM OTHER BORROW AREAS MAY ALSO BE USED FOR CLOSURE.
AT ANY TIME AS SPECIFIED IN
2 BORROW AREAS DESIGNATED FOR USE DURING PREVIOUS CONTRACT WILL BE AVAILABLE FOR USE DURING THIS CONTRACT WHEN THE CONTRACTING OFFICER SO NOTIFIES THE CONTRACTOR IN WRITING AS TO THEIR AVAILABILITY
LEGEND
BORROW AREA (PREVIOUS CONTRACT)
14 JUL 81 REVISED TO REFLECT W.I. CHANGES
U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS
JOE POOL
MOUNTAIN CREEK, TEXAS
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
GENERAL PLAN OF
BORROW AREAS
3

PLATE 19

G
F
E
D
B
A
APPROXIMATE ℄ EMBANKMENT
APPROXIMATE TOE OF EMBANKMENT
BORROW AREA D
BORROW AREA C
BA 218
BA 272
BA 271
BA 270


APPROXIMATE U/S TOE OF EMBANKMENT
APPROXIMATE TOE OF EMBANKMENT
BA 176
BA 177
BA 178
BA 270
BORROW AREA C
BORROW AREA B
FEET
US ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS
JOE POOL
MOUNTAIN CREEK TEXAS
EMBANKMENT SPILLWAY, AND OUTLET WORKS
EXTENT OF BORROW AREA EXCAVATION
BORROW AREAS - I
DATED
DRAWING NUMBER
SHEET NO
109

PLATE 20


G
F
E
D
C
B
A
BORROW AREA E3
BORROW AREA E4
BA-222
Walnut
Creek
6

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL

EMBANKMENT SPILLWAY, AND OUTLET WORKS

EXTENT OF BORROW AREA EXCAVATION

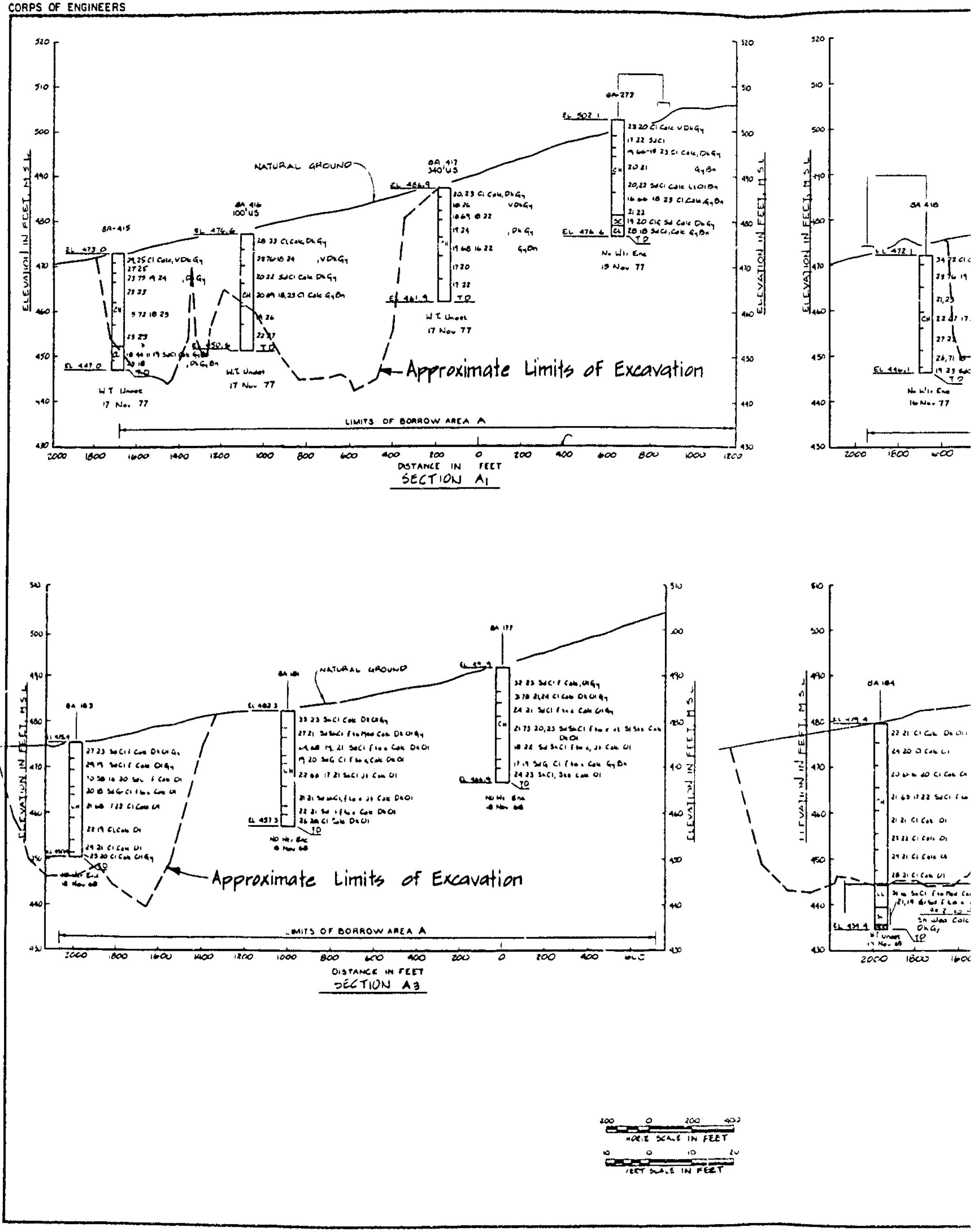
BORROW AREAS-II

E_1, E_2, E_3, E_4 AND E_5

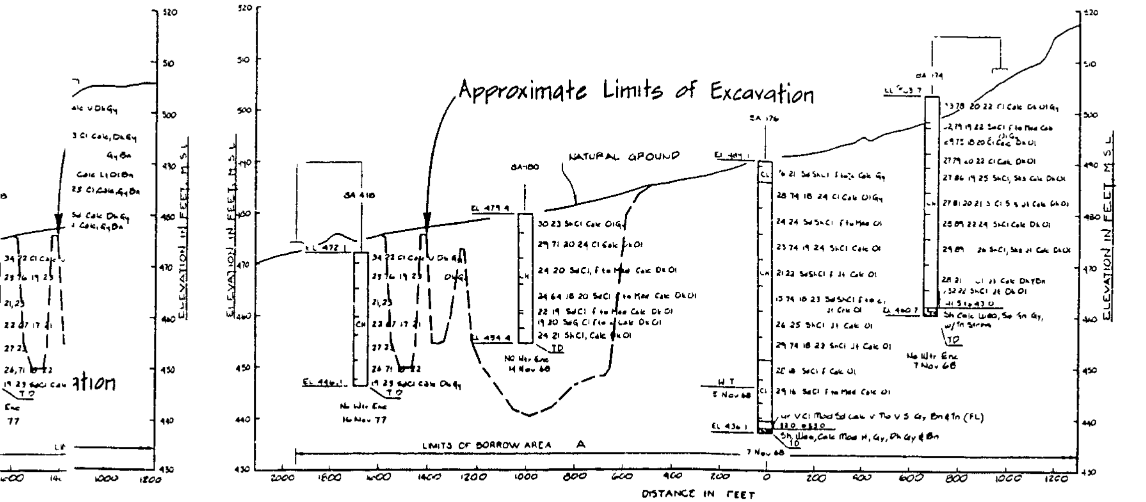
SEQUENCE NO. 110

PLATE 21

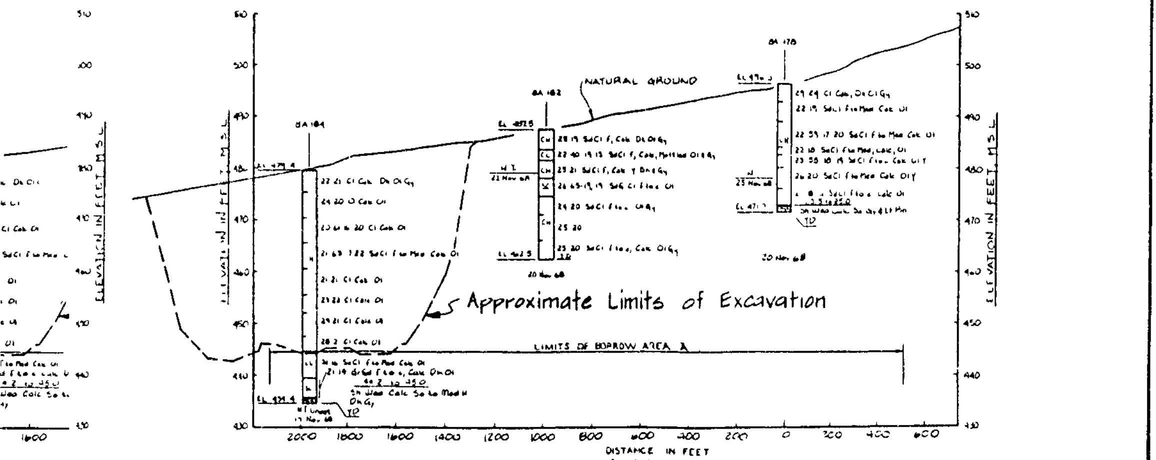
CORPS OF ENGINEERS



US ARMY



SECTION A_2



SECTION A_4

NOTES

1 FOR GENERAL NOTES AND LEGEND SEE SEQ 96
2 BORROW AREAS A, C_2 AND D_3 SHALL BE RESERVED FOR MAKING EMBANKMENT CLOSURE PORTIONS OF BORROW AREA A HAVING NATURAL GROUND ELEVATIONS LESS THAN 483 CAN BE USED AT ANY TIME AS SPECIFIED IN SECTION 2C OF THE SPECIFICATIONS
3 FOR SECTION LOCATIONS SEE SEQ 109

1	4119 0002	3 JULY 81	REVISED TO REFLECT WRITE-IN CHANGES

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

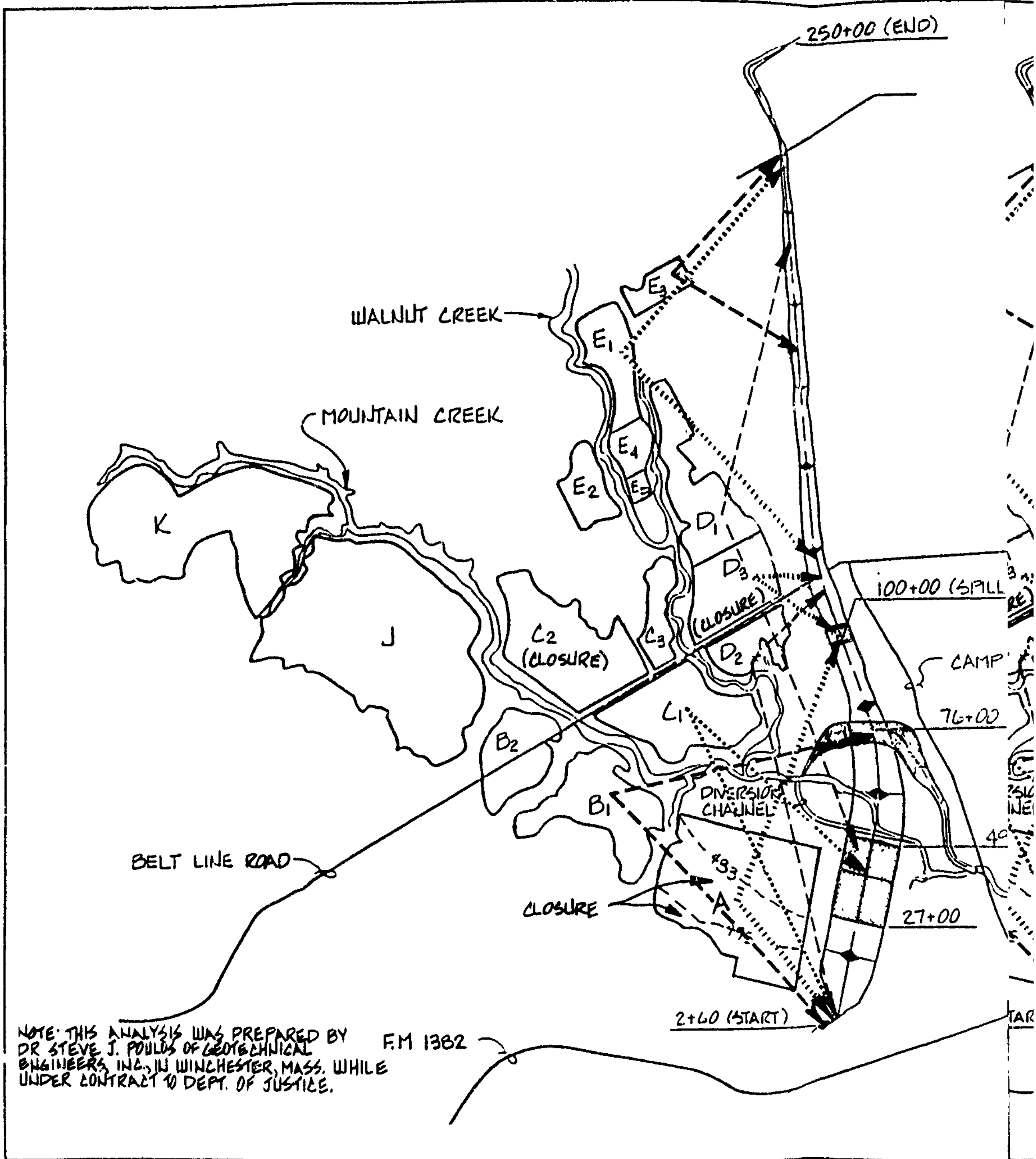
JOE POOL LAKE
MOUNTAIN CREEK TEXAS

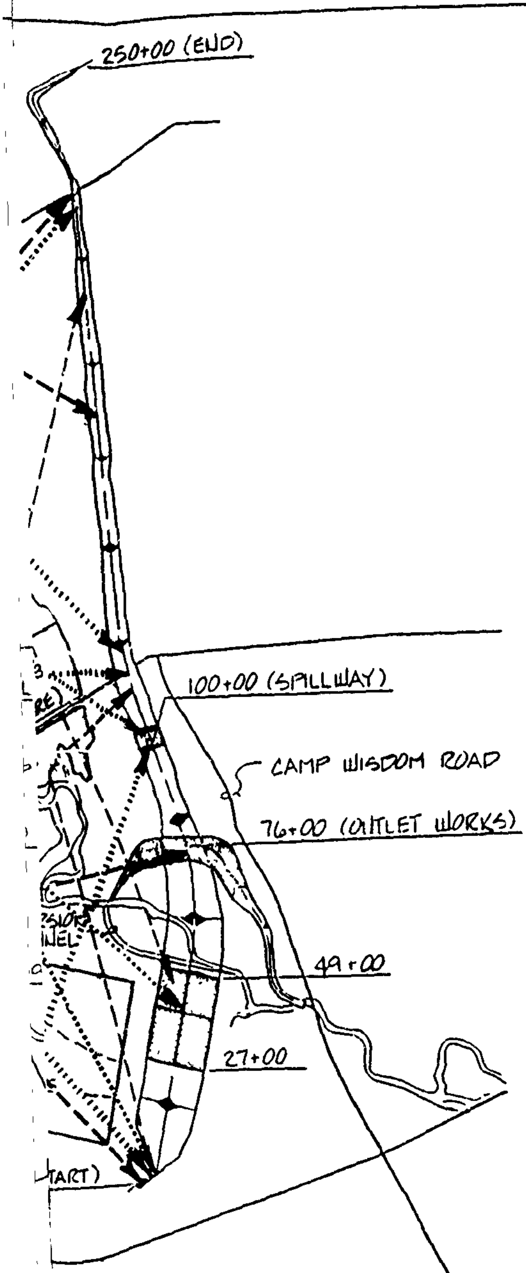
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
EXAMPLE OF EXTENT OF EXCAVATION
BORROW AREA A

Designed by: T SCHMIDT, M NICHOLS
Drawn by: M SCOVILLE
Reviewed by: T SCHMIDT
Submitted by:

INV NO DACW63-81 B-0093
DATE
DRAWING NUMBER
SHEET NO OF
SEQUENCE NO 112

PLATE 22


250+00 (END)
WALNUT CREEK
MOUNTAIN CREEK
K
J
E1
E2
E3
E4
E5
D1
D2
D3
C1
C2
(CLOSURE)
C3
(CLOSURE)
B1
B2
A
100+00 (SPILL
CAMP
76+00
DIVERSION CHANNEL
27+00
2+60 (START)
BELT LINE ROAD
CLOSURE
F.M 1382
NOTE: THIS ANALYSIS WAS PREPARED BY DR STEVE J. POULOS OF GEOTECHNICAL ENGINEERS, INC., IN WINCHESTER, MASS. WHILE UNDER CONTRACT TO DEPT. OF JUSTICE.



LEGEND:

1st CONTRACT

ARROWS INDICATE WHERE MATERIALS FROM THE BORROW AREAS WERE PLACED IN THE DAM

1000 0 1000 5000

SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

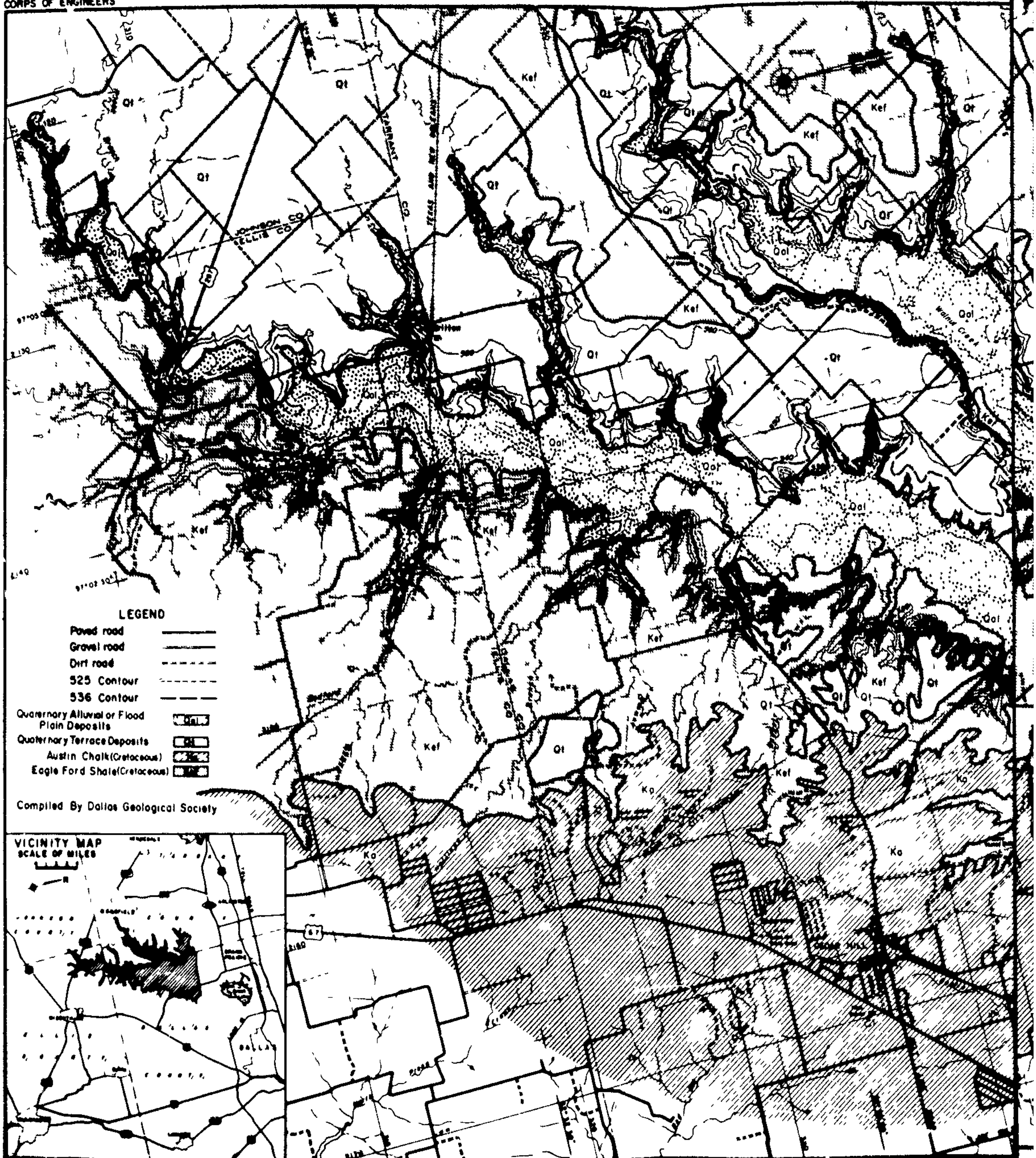
S. POULAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

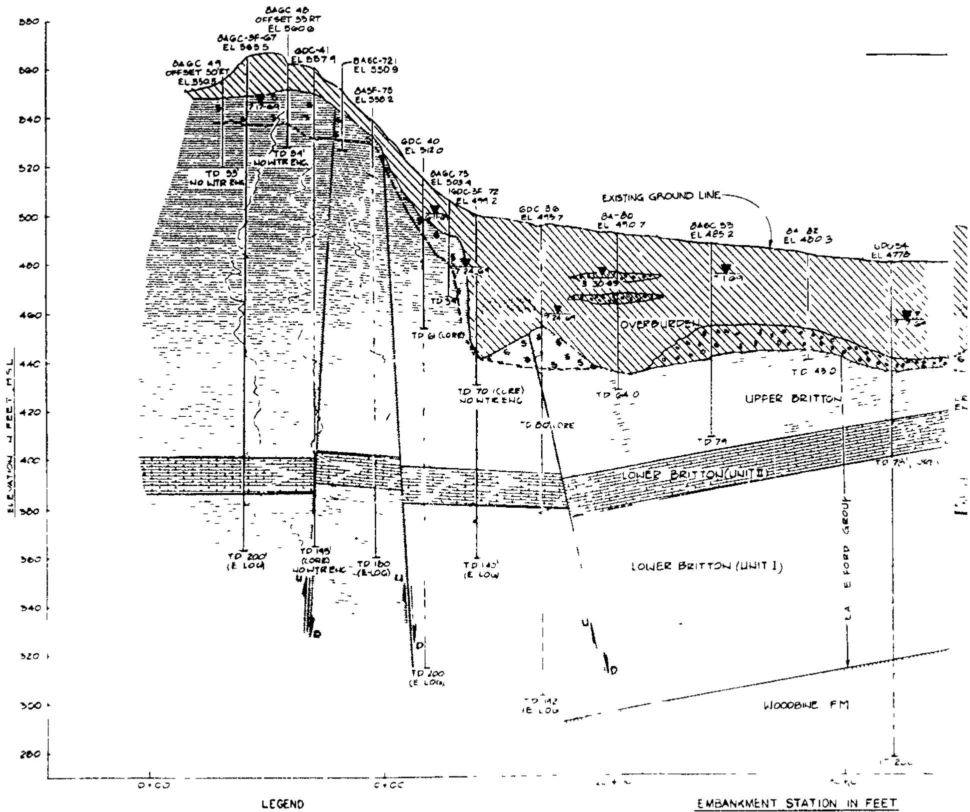
MATERIALS SOURCE AND PLACEMENT LOCATIONS
COMPLETION CONTRACT

33 of 43


LEGEND
Paved road
Gravel road
Dirt road
525 Contour
536 Contour
Quaternary Alluvial or Flood Plain Deposits
Quaternary Terrace Deposits
Austin Chalk (Cretaceous)
Eagle Ford Shale (Cretaceous)
Compiled By Dallas Geological Society
VICINITY MAP
SCALE OF MILES
JOHNSON CO
ELLIS CO
TARRANT CO
Qt
Qal
Kef
Ka
Walnut Creek
DALLAS


US ARMY
Kef
Qt
Qal
Ko
TARRANT CO
DALLAS CO
INTERSTATE HWY NO 20
SITE 6
℄ JOE POOL DAM
LOCATION OF OUTLET WORKS
Mountain
U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
AREAL GEOLOGY MAP
MARR
3

PLATE 24



LEGEND

LITHOLOGIC DESCRIPTION

ALLUVIUM
- CLAY VARIABLY SANDY SILTY
- CLAY SANDY-GRAVELLY
- SAND CLAYEY
- GRAVEL SANDY CLAYEY

EAGLE FORD GROUP
- SHALE (UPPER BRITTON MEMBER) SOFT TO MODERATELY HARD, SLIGHTLY CALCAREOUS, DARK GRAY
- MARL (LOWER BRITTON MEMBER UNIT II) MODERATELY HARD TO HARD MASSIVE, GRAY
- SHALE (LOWER BRITTON MEMBER-UNIT I) MODERATELY HARD, CALCAREOUS DARK GRAY, WITH SEVERAL SOFT BENTONITE SEAMS RANGING FROM 0.05' TO 1.0' THICK

WOODBINE FORMATION
- INTERBEDDED SANDSTONE AND SHALE

MISCELLANEOUS

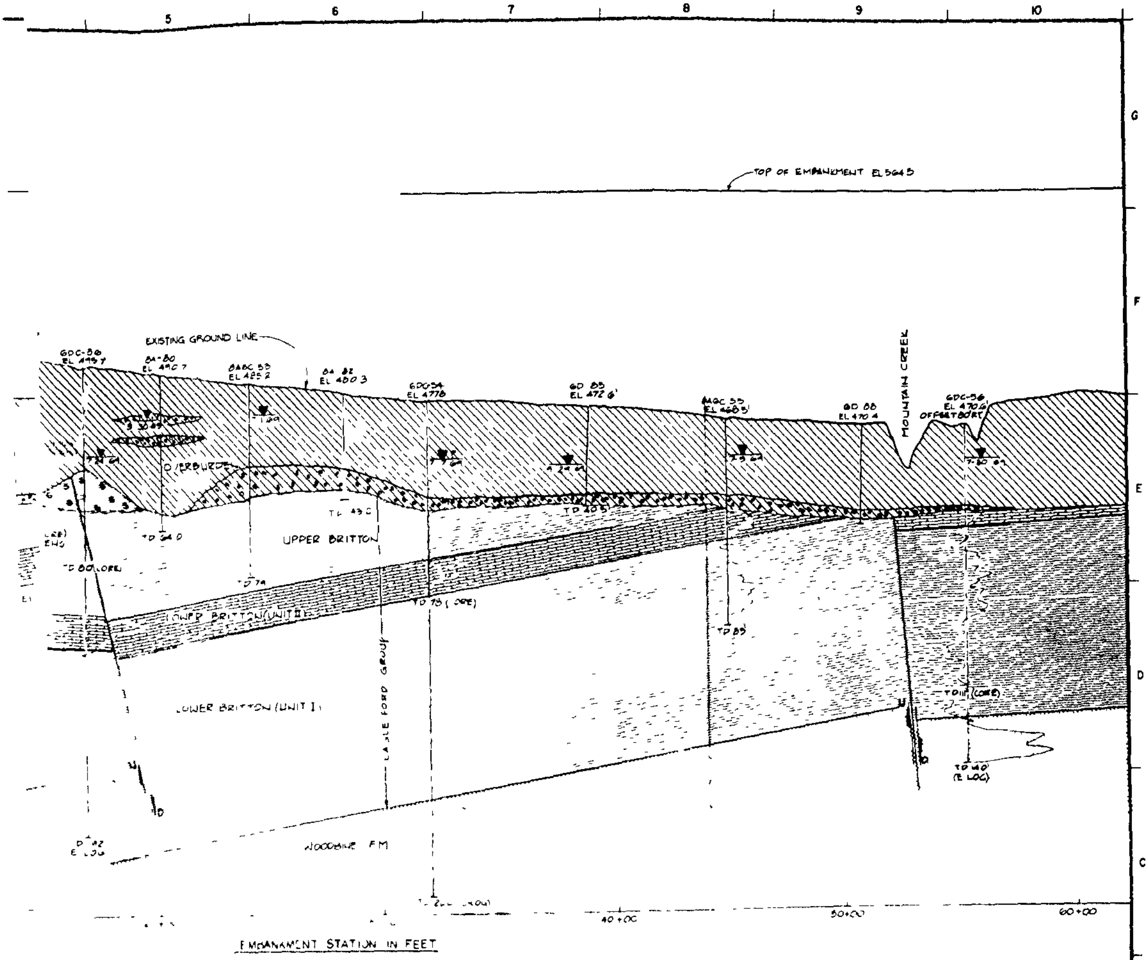
- DENOTES WEATHERING (LEACHED OXIDIZED OPEN JOINTS AND FRACTURES)
- D/U INFERRED FAULT PLANE
- STATIC WATER LEVEL / 5 SEPT 77 DATE OF LEVEL
- 8A 8 INCH AUGER BORING
- CH 36 INCH CALYX BORING
- 6C 6 INCH CORE BORING
- 6D 6 INCH DENISON SAMPLE BORING
- 3F 3 INCH FISHTAIL BORING
- TD TOTAL DEPTH
- SINGLE POINT RESISTIVITY ELECTRIC LOG (E LOG)

NOTES

1 DETAILED LOGS OF CORE BORI

2 WHILE THE BORINGS AND GEOLO SUBSURFACE CONDITIONS FOR SHOWN VARIATIONS IN CHARAC

3 ABSENCE OF GROUND WATER NECESSARILY MEAN THAT GRO THE LOCATION OR WITHIN TH



BORIN
GEOLO LEACHED OXIDIZED OPEN JOINTS
OR T
ARAC

TER I
GROU
I THI

NOTES

1 DETAILED LOGS OF CORE BORINGS ARE PRESENTED ON SEQ ___ THRU SEQ ___

2 WHILE THE BORINGS AND GEOLOGIC INTERPRETATIONS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS FOR THE VERTICAL AND HORIZONTAL REACHES AS SHOWN VARIATIONS IN CHARACTERISTICS OF MATERIALS MAY BE ENCOUNTERED

3 ABSENCE OF GROUND WATER LEVELS OPPOSITE BORING LOGS DOES NOT NECESSARILY MEAN THAT GROUND WATER WILL NOT BE ENCOUNTERED AT THE LOCATION OR WITHIN THE VERTICAL REACHES OF THE BORINGS

E BORING

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

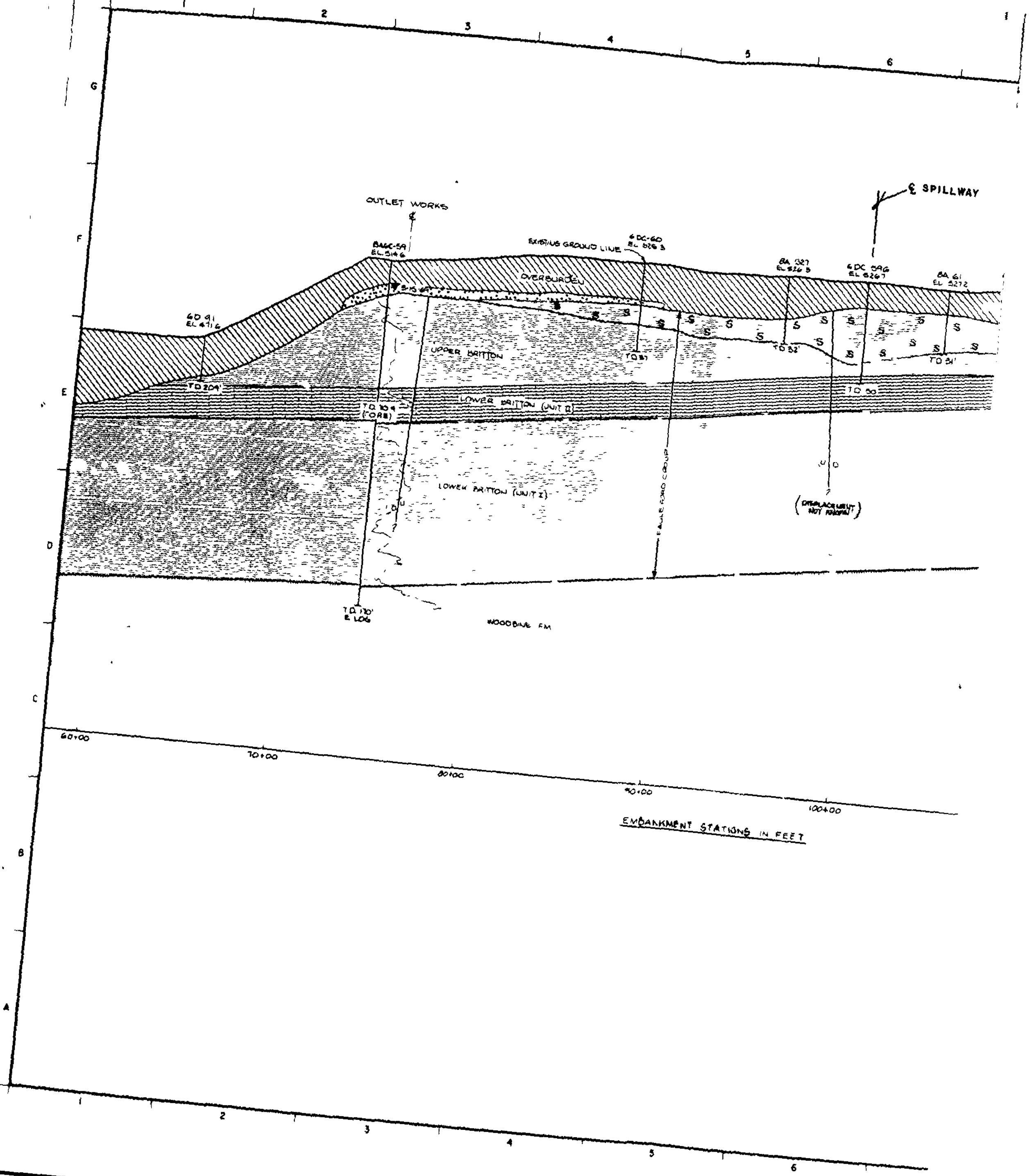
GEOLOGIC PROFILE
EMBANKMENT CENTERLINE
(STATION 0+00 TO STATION 62+00)

DRAWN BY MARR

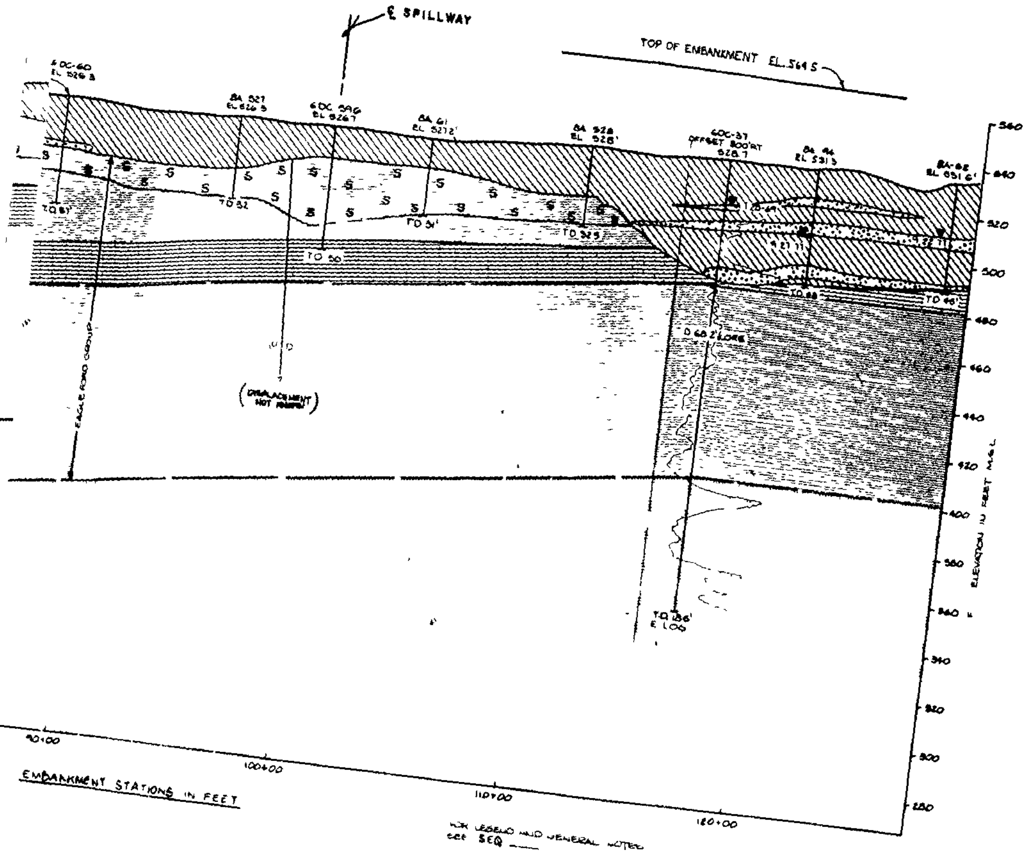
DATED JULY 1981

5 6 7

PLATE 25



OUTLET WORKS
℄ SPILLWAY
EXISTING GROUND LINE
OVERBURDEN
UPPER BRITTON
LOWER BRITTON (UNIT II)
LOWER BRITTON (UNIT I)
WOODBINE FM
(DISPLACEMENT NOT KNOWN)
TD 204'
T.D. 109 (CORE)
T.D. 170' E LOG
TD 37
TD 52'
TD 50
TD 51'
60+00
70+00
80+00
90+00
100+00
EMBANKMENT STATIONS IN FEET



U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

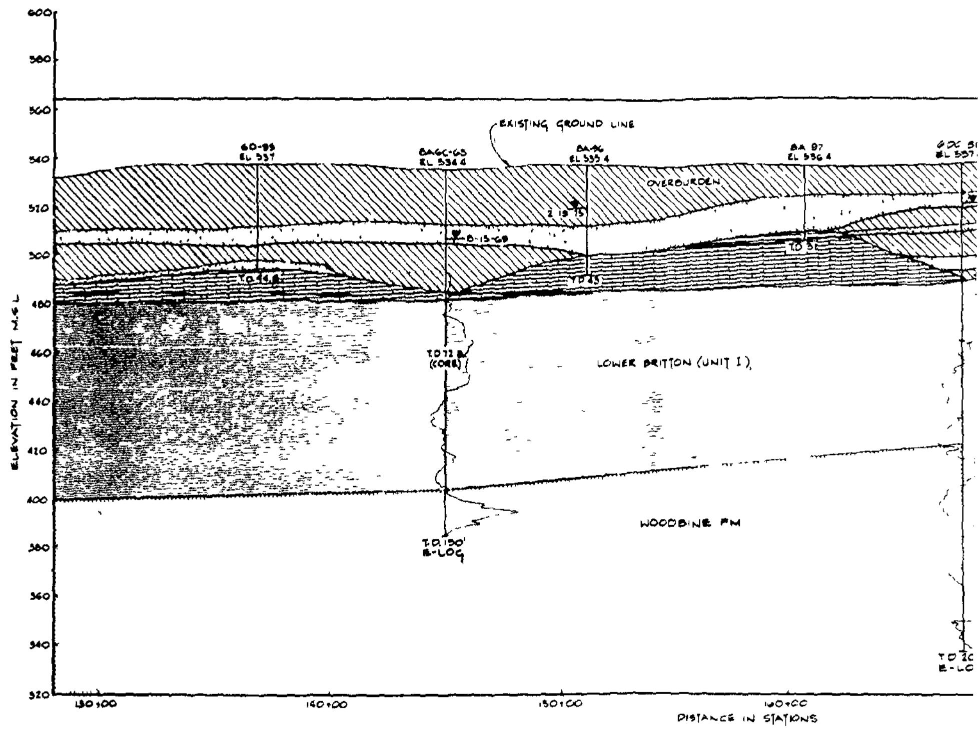
EMBANKMENT, SPILLWAY, AND OUTLET WORKS

GEOLOGIC PROFILE
EMBANKMENT CENTERLINE
(STA 62+00 TO STA 128+00)

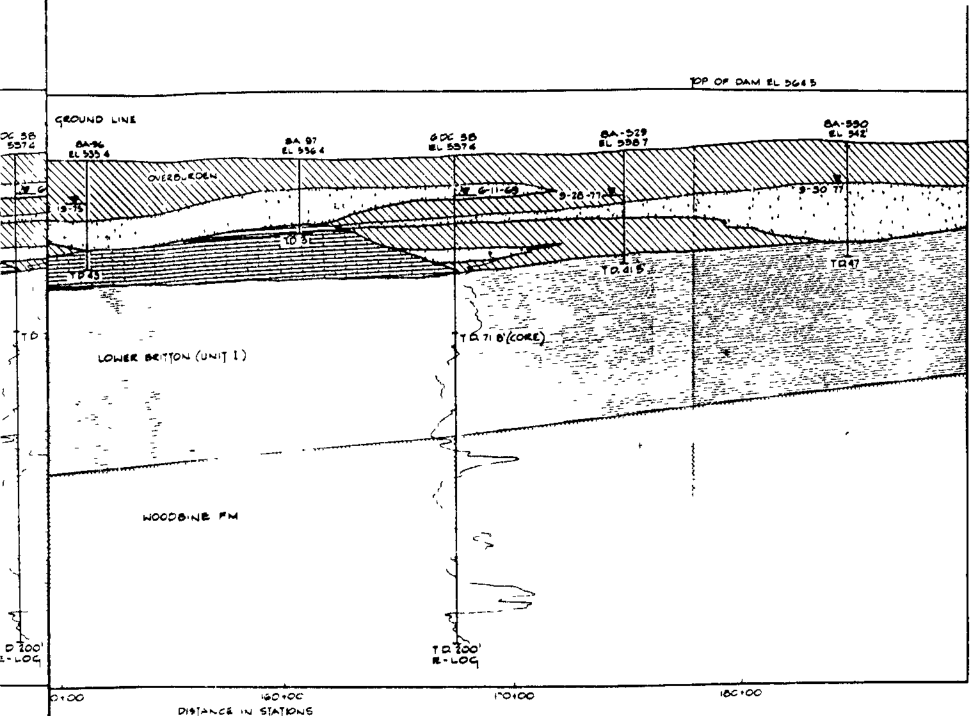
DRAWN BY: MARR

DATED: JULY 1981

PLATE 26


EXISTING GROUND LINE
BAGC-65
EL 534.4
BA-96
EL 535.4
BA 97
EL 536.4
OVERBURDEN
2-19-75
8-15-69
T.D. 51
T.D. 45
T.D. 72.8
(CORE)
LOWER BRITTON (UNIT I)
WOODBINE FM
T.D. 150'
E-LOG
ELEVATION IN FEET M.S.L.
600
580
560
540
520
500
480
460
440
420
400
380
360
340
320
130+00
140+00
150+00
160+00
DISTANCE IN STATIONS

PROFILE



PROFILE

FOR LEGEND AND GENERAL NOTES SEE SEQ ——

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

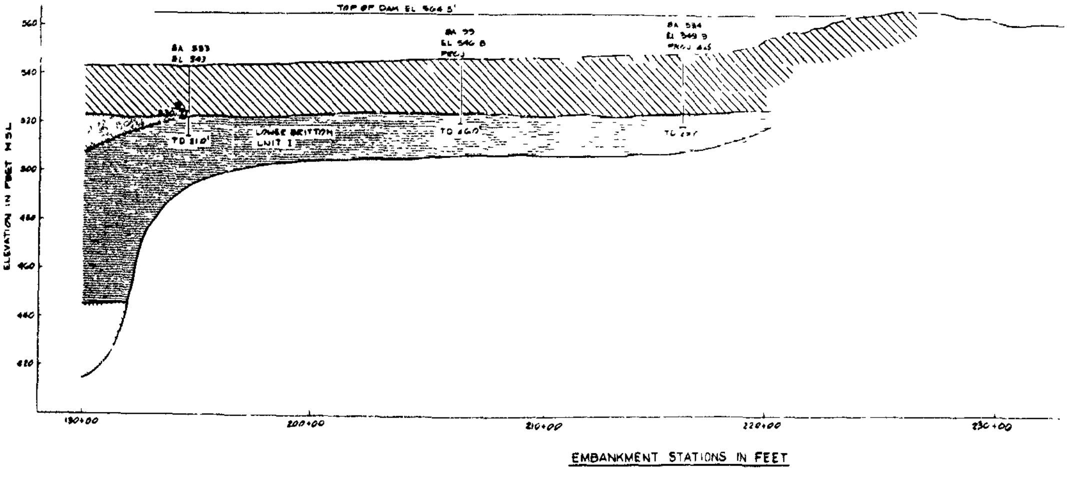
GEOLOGIC PROFILE
EMBANKMENT CENTERLINE
(STA 128+00 TO STA 190+00)

DRAWN BY: MARR

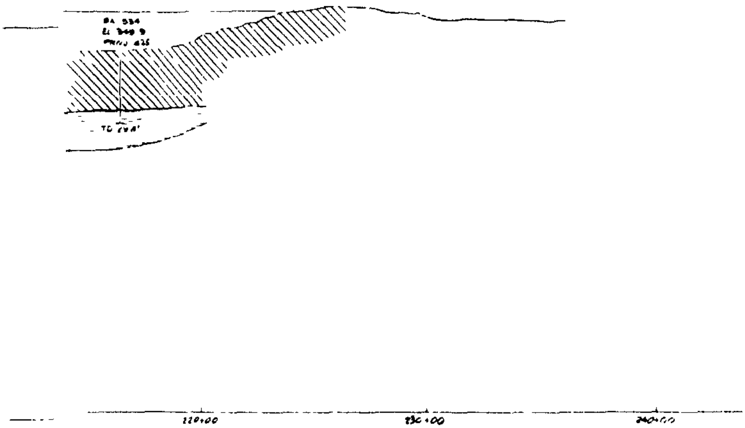
DATED JULY 1981

10

PLATE 27



TOP OF DAM EL 564 5'
BA 533
EL 543
TD 310'
LOWER BRITTON
UNIT I
EL 546 8
PROJ
BA 534
ELEVATION IN FEET MSL
560
540
520
500
480
460
440
420
190+00
200+00
210+00
220+00
230+00
EMBANKMENT STATIONS IN FEET



ENT STATIONS IN FEET

FOR LEGEND AND GENERAL NOTES SEE SEQ ___

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

GEOLOGIC PROFILE
EMBANKMENT CENTERLINE
(STATION 190+00 TO 225+00)

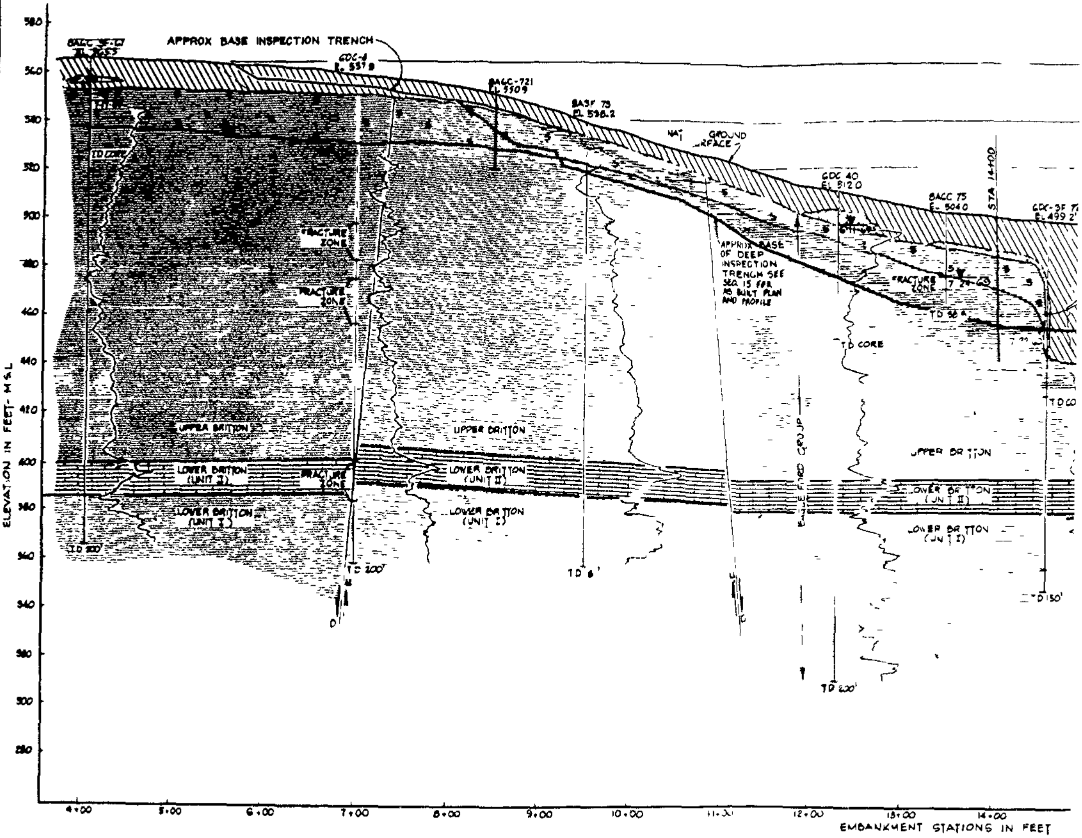
DRAWN BY MARR

INV NO DACW 63-81-E-0073

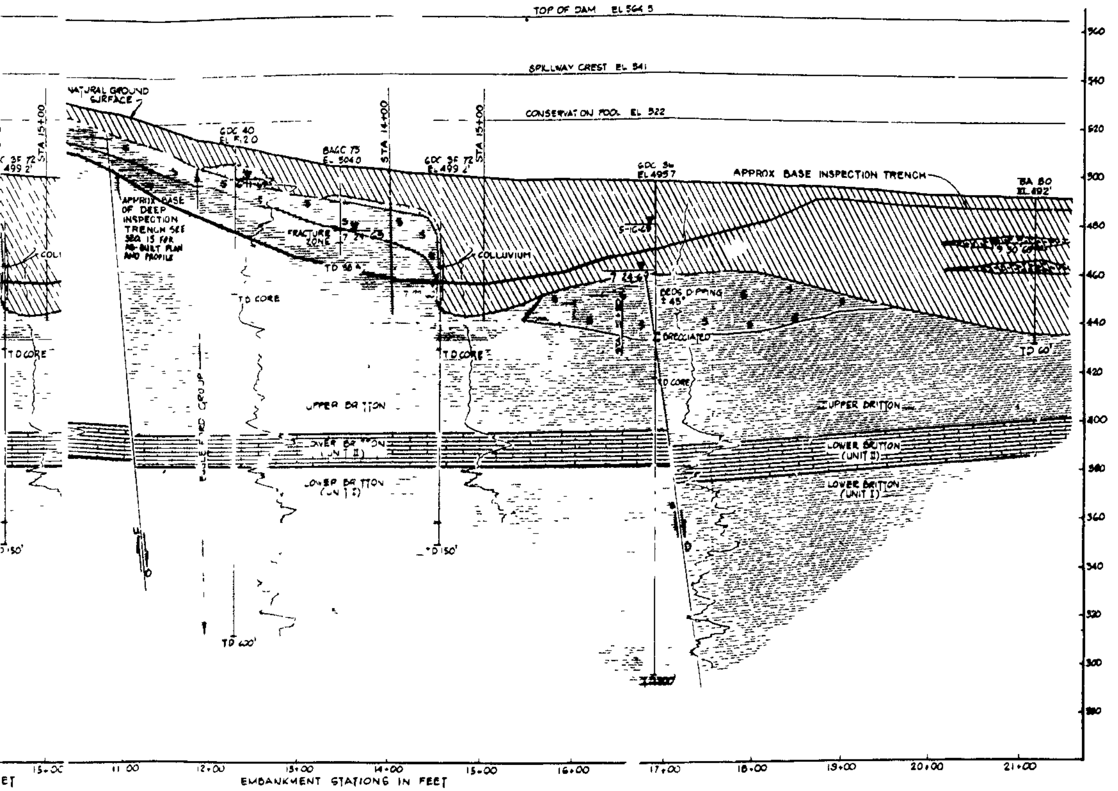
DATED JULY 1981

SHEET NO 11

PLATE 28



NOTE
1. FO
2. SE
FR



NOTE

1. FOR LEGEND AND GENERAL NOTES SEE SEQ ____
2. SEE PLATE 30 FOR AS-BUILT PLAN AND PROFILE OF DEEP INSPECTION TRENCH

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

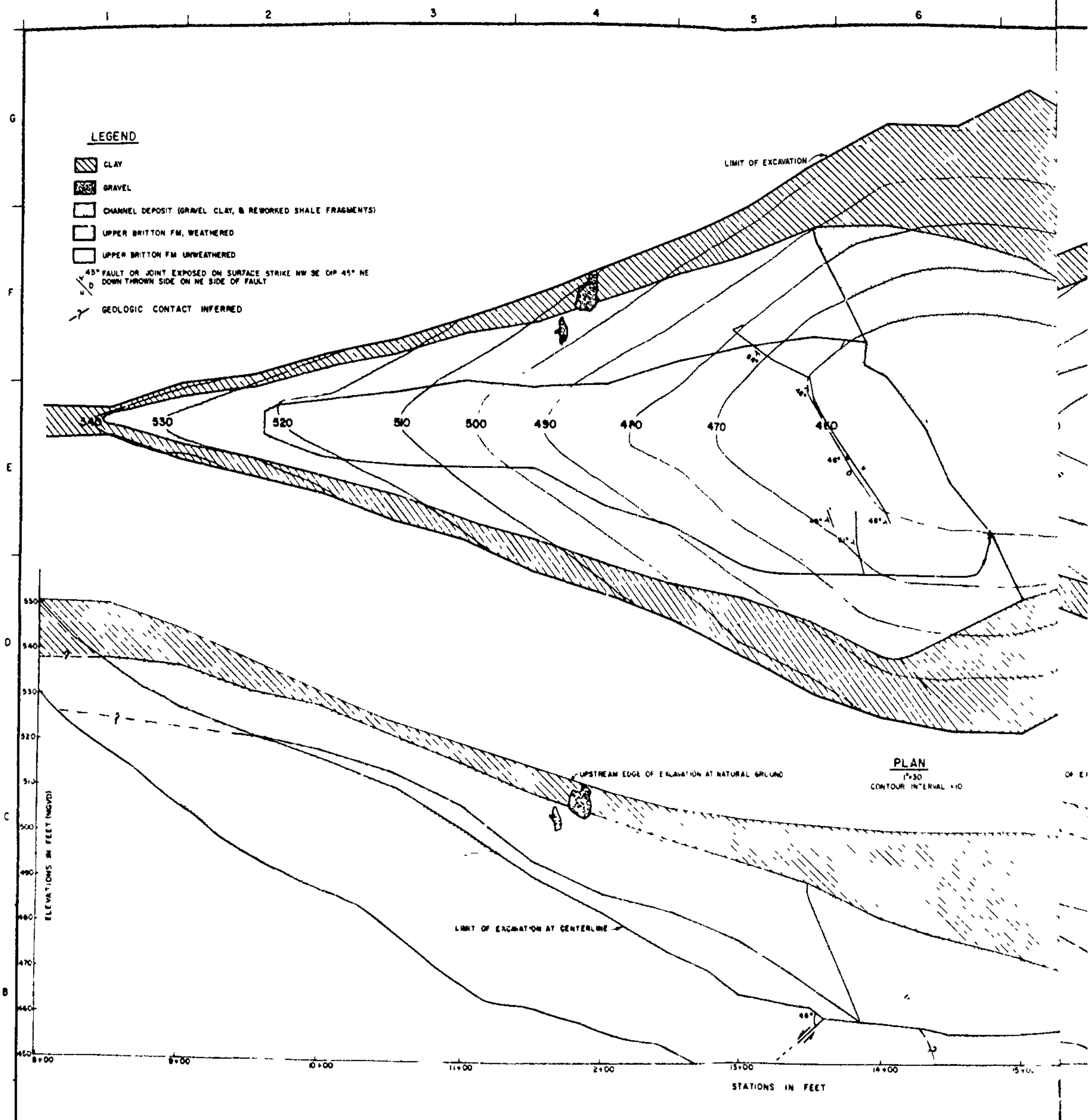
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
GEOLOGIC PROFILE
EMBANKMENT CENTERLINE
EMBANKMENT CENTERLINE-RIGHT ABUTMENT

DRAWN BY MARR

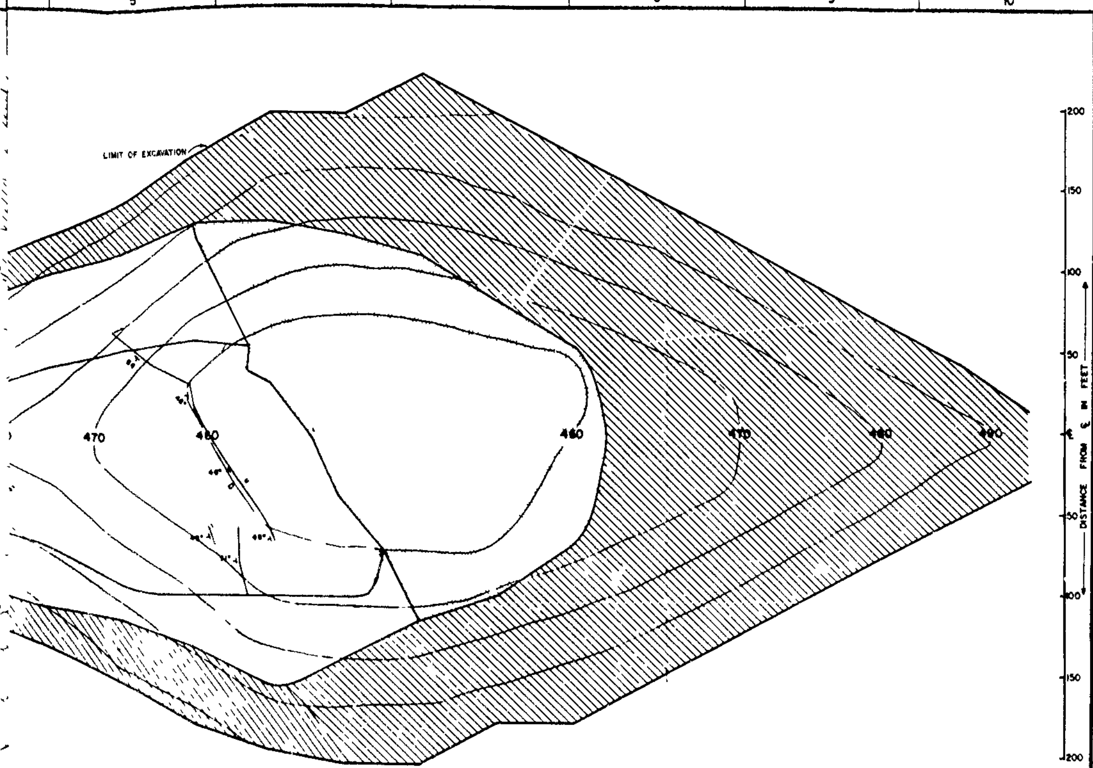
INV NO. DACW 63-81-B-0093
DATED JULY 1981

SEQUENCE NO. 13

PLATE 29

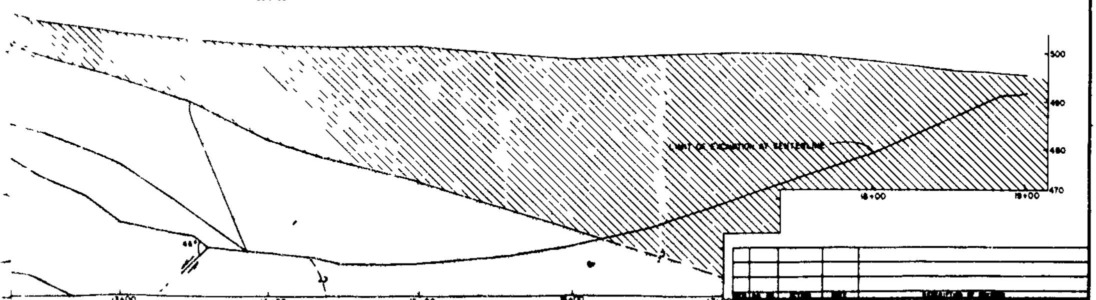


℄ PROFILE AND MAP OF UPSTREAM EXCAVATION SLOPE
1" = 30' HORIZ 1" = 10 VERT



PLAN
1"=30'
CONTOUR INTERVAL +10

LIMIT OF EXCAVATION AT NATURAL GROUND



STATIONS IN FEET

PROFILE AND MAP OF UPSTREAM EXCAVATION SLOPE
1" = 30' HORIZ 1" = 10 VERT

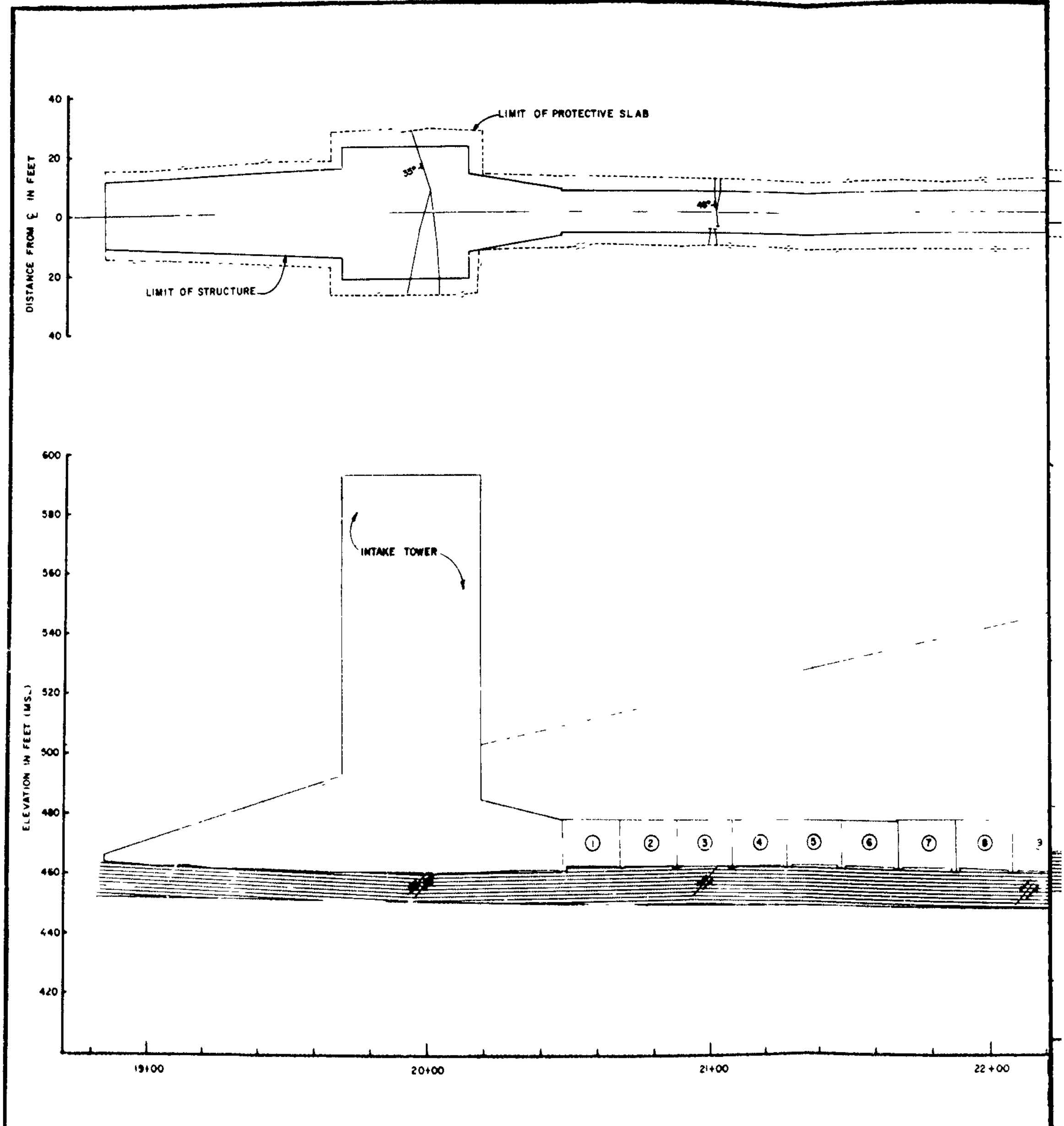
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

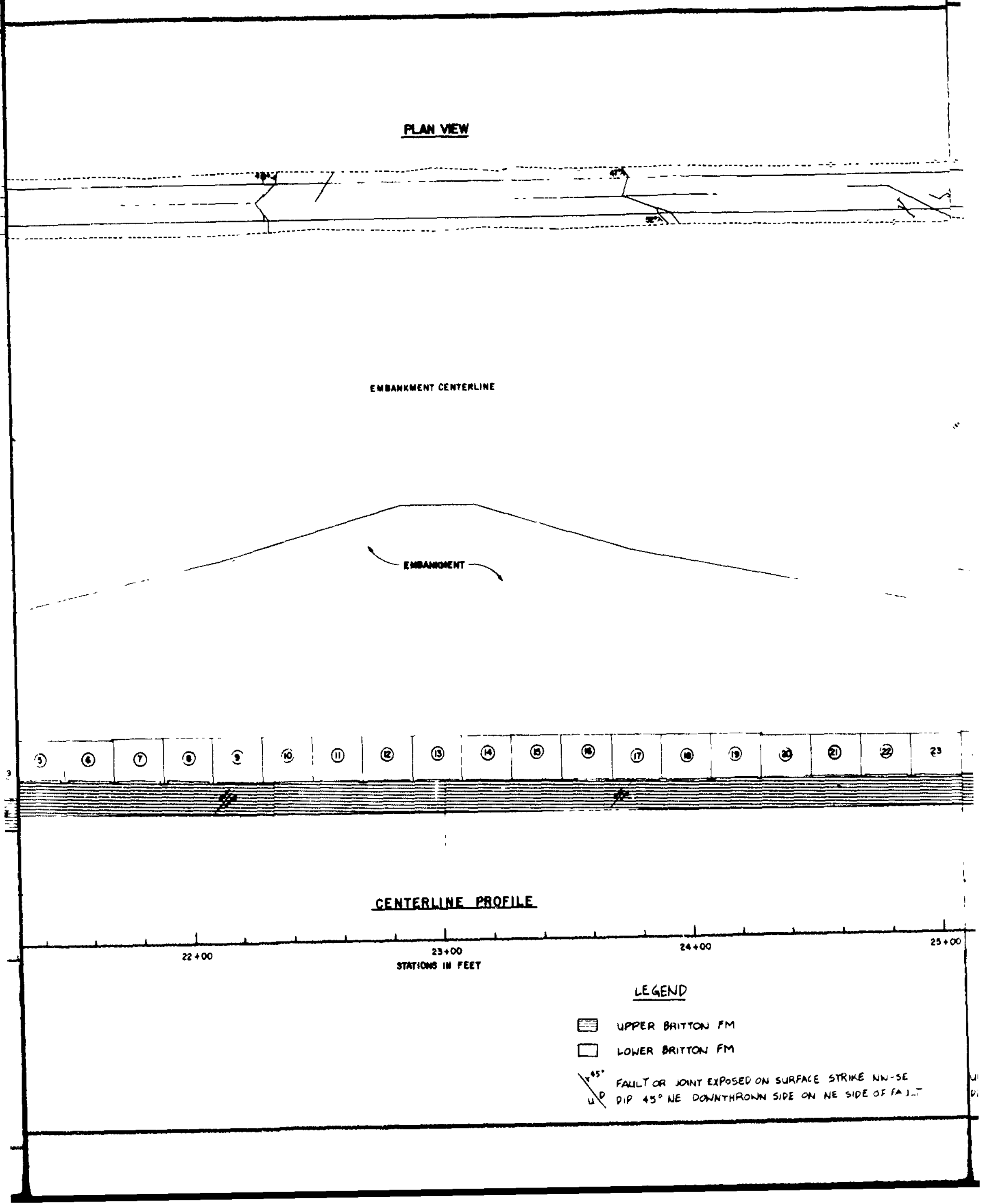
RIGHT ABUTMENT
DEEP INSPECTION TRENCH
AS-BUILT PLAN AND PROFILE
STATION 8+00 TO 19+00

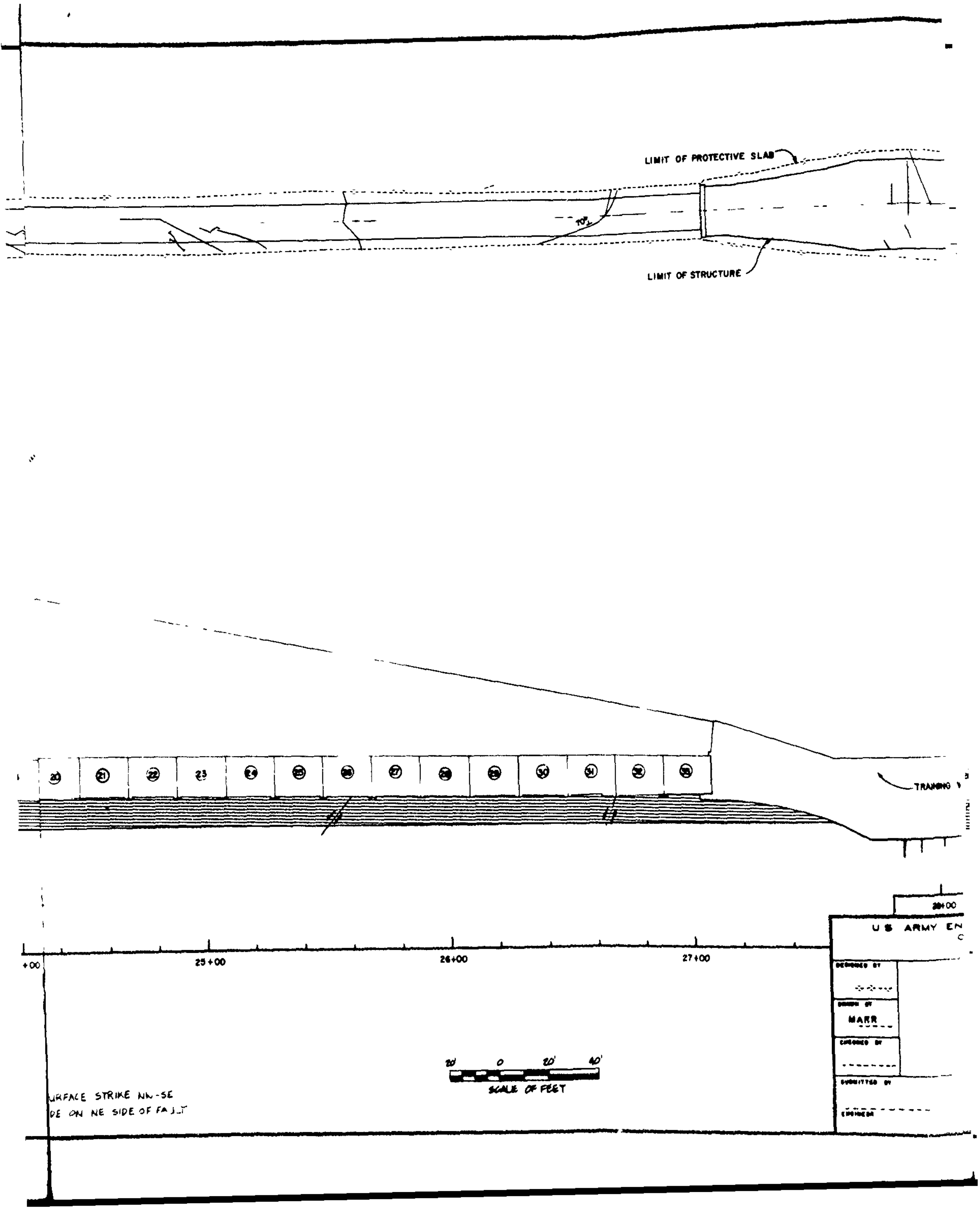
DRAWN BY A MARR

PLATE 30

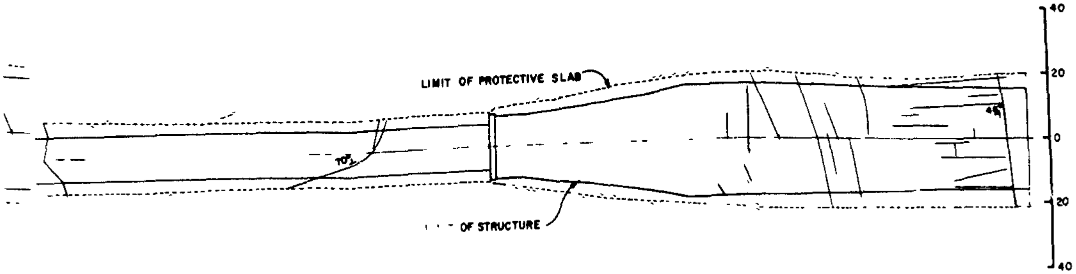


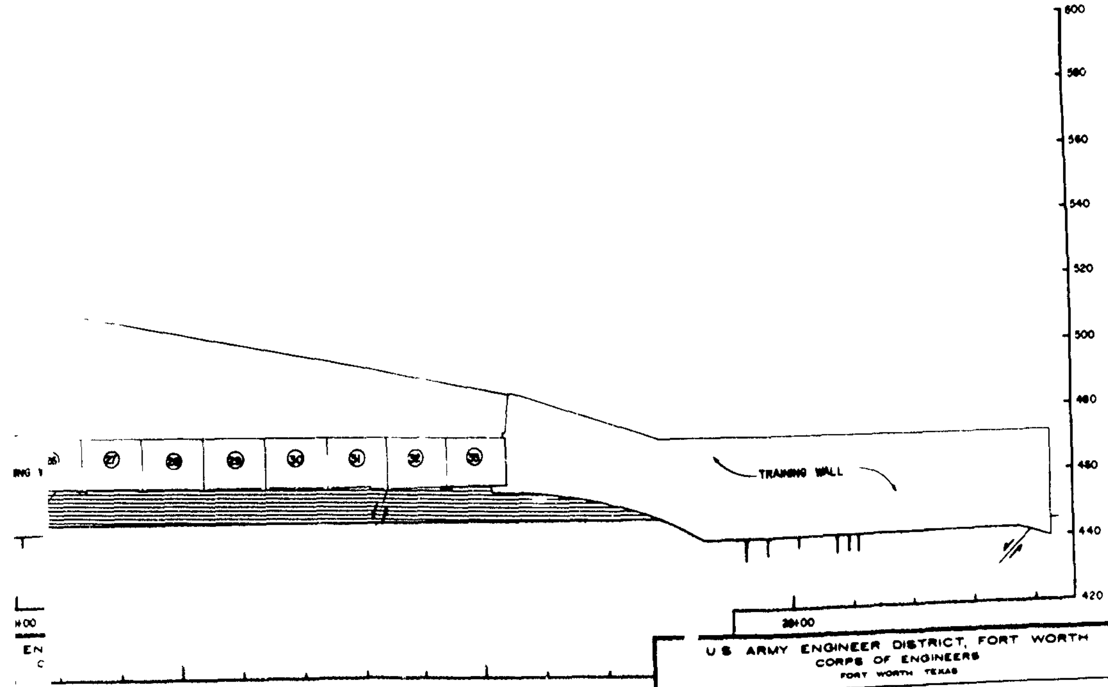
LIMIT OF PROTECTIVE SLAB
LIMIT OF STRUCTURE
DISTANCE FROM ℄ IN FEET
35°
46°
40
20
0
20
40
INTAKE TOWER
ELEVATION IN FEET (MSL)
600
580
560
540
520
500
480
460
440
420
1
2
3
4
5
6
7
8
9
19+00
20+00
21+00
22+00


PLAN VIEW
EMBANKMENT CENTERLINE
EMBANKMENT
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
CENTERLINE PROFILE
22+00
23+00
24+00
25+00
STATIONS IN FEET
LEGEND
UPPER BRITTON FM
LOWER BRITTON FM
FAULT OR JOINT EXPOSED ON SURFACE STRIKE NW-SE
DIP 45° NE DOWNTHROWN SIDE ON NE SIDE OF FAULT



LIMIT OF PROTECTIVE SLAB
70°
LIMIT OF STRUCTURE
20
21
22
23
24
25
26
27
28
29
30
31
32
33
TRAINING
28+00
+00
25+00
26+00
27+00
U S ARMY EN
DESIGNED BY
DRAWN BY
MARR
CHECKED BY
SUBMITTED BY
ENGINEER
20' 0 20' 40'
SCALE OF FEET
URFACE STRIKE NW-SE
DE ON NE SIDE OF FAULT





U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

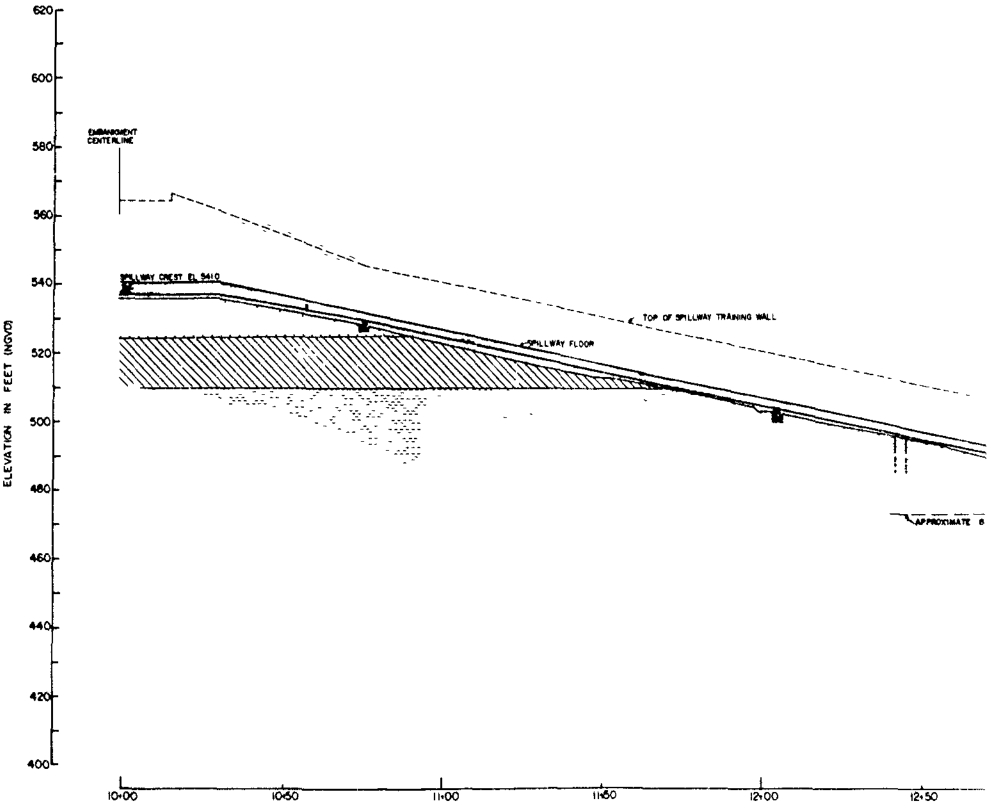
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

OUTLET WORKS

STRUCTURE FOUNDATION
AS-BUILT PLAN & PROFILE

DESIGNED BY
DRAWN BY MARR
CHECKED BY
SUBMITTED BY
ENGINEER
INV NO
DATED
CONTR NO
DRAWING NUMBER
SHEET NO
PLATE

PLATE 31

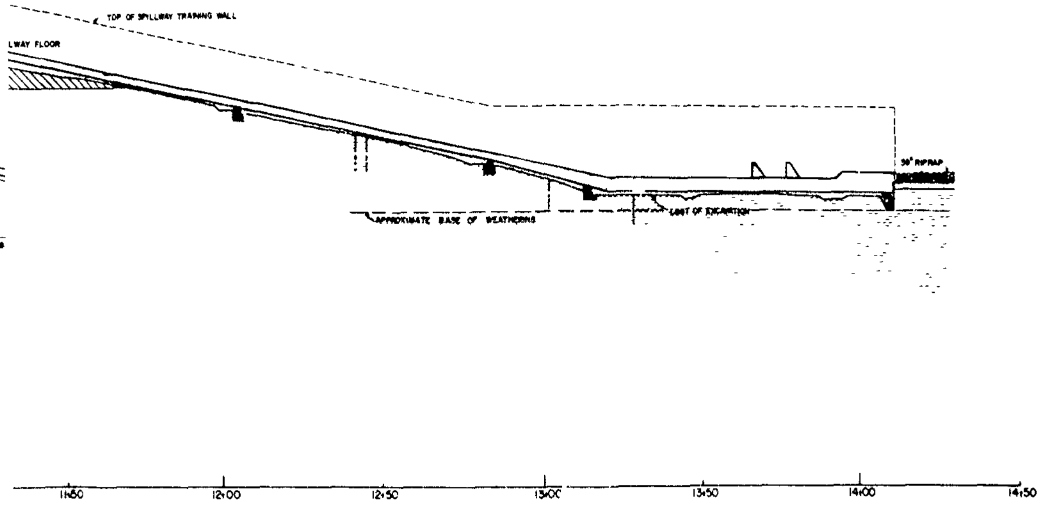


STATIONS IN FEET

SPILLWAY PROFILE

LEGEND

- STRUCTURAL CONCRETE
- FILTER SAND
- FILL (INITIAL CONTRACT)
- OVERBURDEN (CLAY, SANDY)
- UPPER BRITTON FM
- VERTICAL JOINT INTERSECTS EXCAVATION SURFACE



STATIONS IN FEET

SPILLWAY PROFILE

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

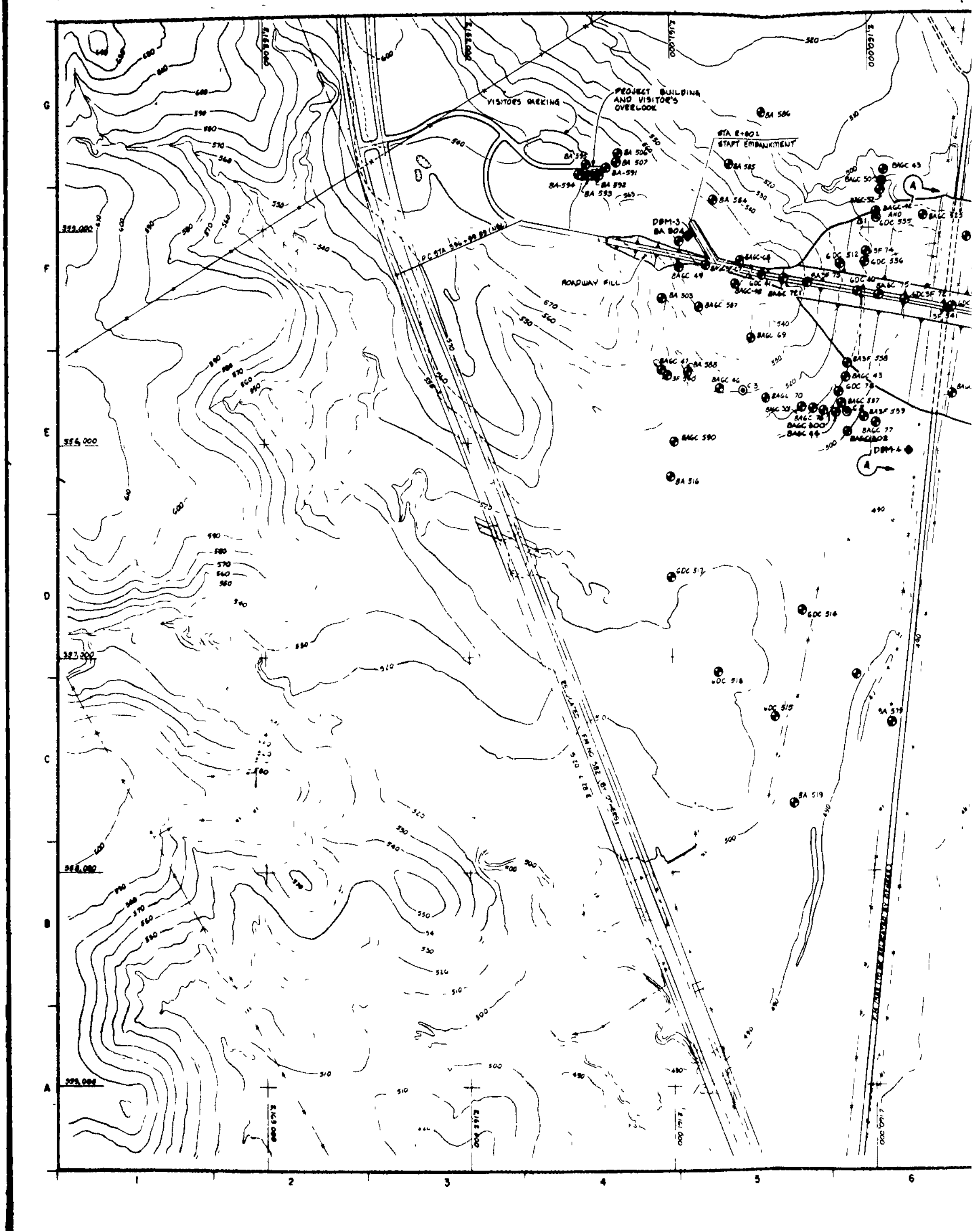
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

GEOLOGIC PROFILE

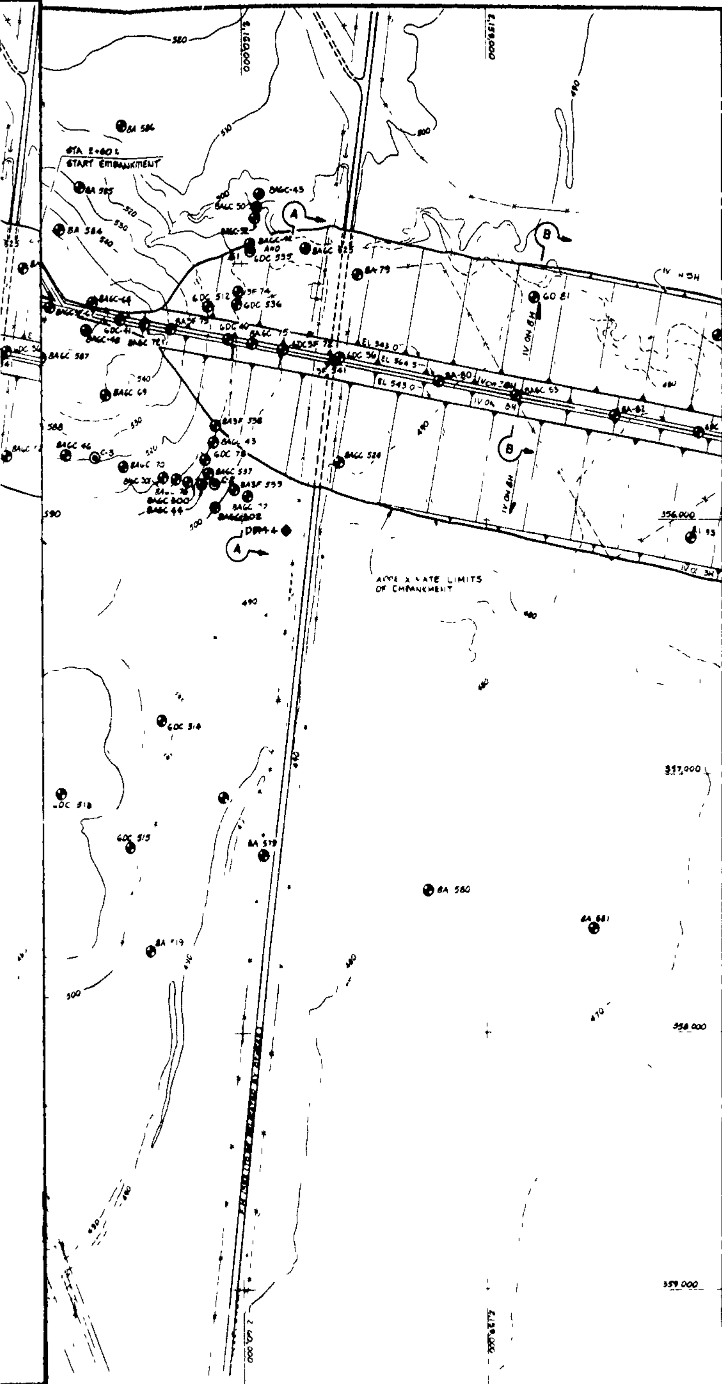
SPILLWAY CENTERLINE (AS-BUILT)

DRAWN BY: MARR

PLATE 32



PROJECT BUILDING AND VISITOR'S OVERLOOK
VISITORS PARKING
STA 2+60.2
START EMBANKMENT
ROADWAY FILL
DBM-3
BA 804
DBM-4
BA 506
BA 507
BA-591
BA-594
BA 592
BA 593
BA 585
BA 584
BA 586
BA 503
BAGC 587
BAGC 69
BAGC 49
BAGC 43
BAGC 590
BA 516
GDC 517
GDC 514
GDC 518
GDC 515
BA 519
BA 579
BA 588
BAGC 70
BAGC 77
BAGC 800
BAGC 44
BA3F 558
BA3F 559
GDC 512
GDC 536
GDC 535
GDC 78
P.C. STA 596+99.89
RELOCATED FM NO. 582
559,000
556,000
557,500
558,000
555,000
2,158,000
2,159,000
2,160,000
2,161,000
2,162,000
2,163,000
G
F
E
D
C
B
A
1
2
3
4
5
6



N

LEGEND

- CAYLX HOLE
- BORING
- DEEP BENCH MARK (THIS CONTRACT)

DEEP BENCH MARK SCHEDULE			
DBM	STATION	OFFSET	DEPTH
1	139+00	800'DS	*
2	92+00	300'DS	*
3	5+00	70'DS	35'
4	18+00	700'DS	45'
5	69+00	750'DS	50'
6	225+00	℄	50'

* INDICATES EXISTING DEEP BENCH MARK

NOTES
1 USE THIS PLAN FOR BORING, SECTION, AND DEEP BENCH MARK LOCATIONS ONLY
2 FOR SECTIONS A A AND B B SEE SEQ.__

200 0 200 400
SCALE IN FEET

U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T SCHMIDT, M NICHOLS
DRAWN BY M POTTS
REVIEWED BY T SCHMIDT

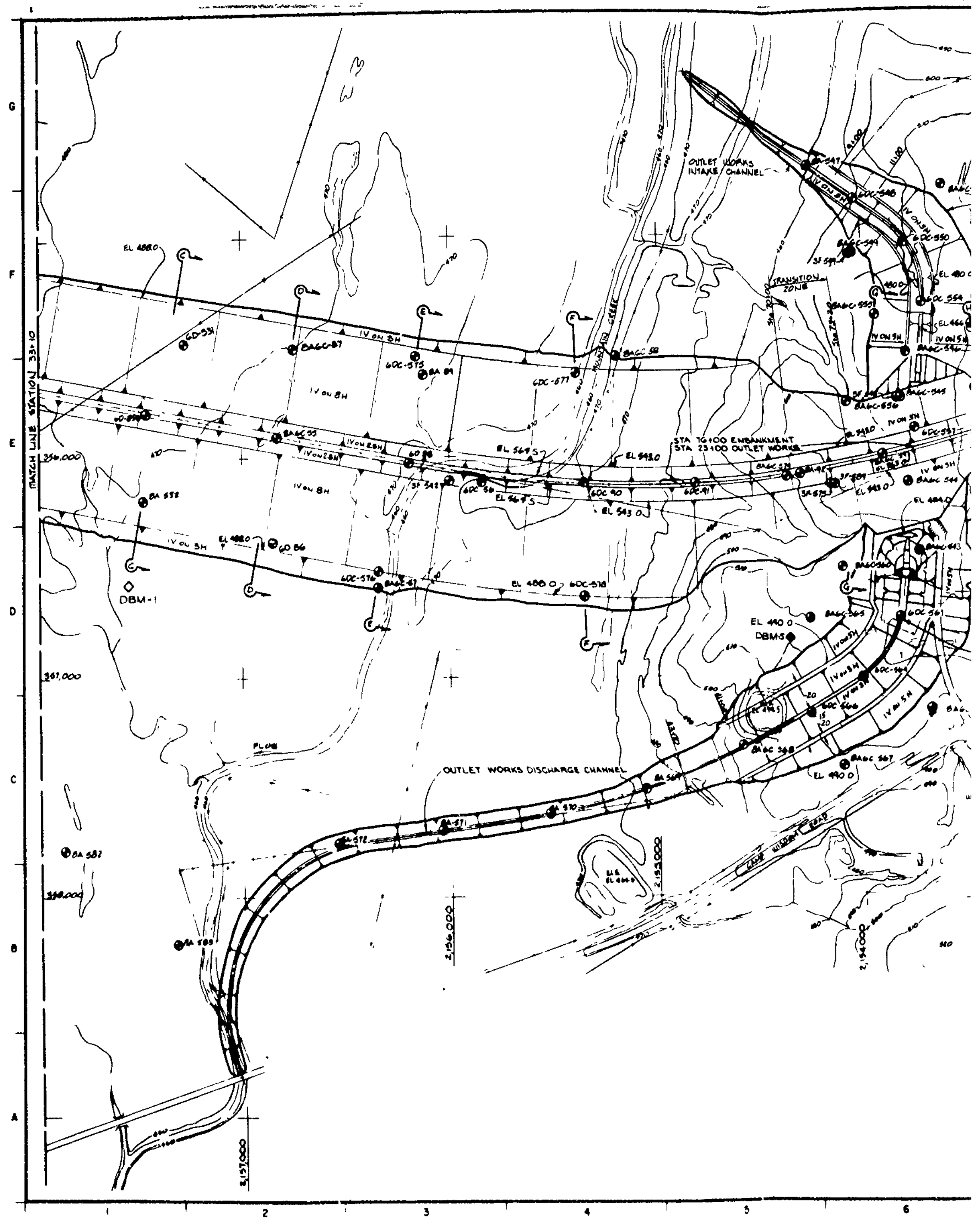
JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

PLAN OF BORINGS I
STATION 2+60 TO STATION 33+10

DATED JULY 1981
SHEET NO 3 of 45
88

PLATE 33



OUTLET WORKS INTAKE CHANNEL
TRANSITION ZONE
STA 76+00 EMBANKMENT
STA 25+00 OUTLET WORKS
OUTLET WORKS DISCHARGE CHANNEL
MATCH LINE STATION 33+10
1V ON 8H
1V ON 3H
1V ON 5H
EL 488.0
EL 569.5
EL 543.0
EL 490.0
DBM-1
DBM-5
356,000
357,000
358,000
2,156,000
2,157,000
2,155,000
G
F
E
D
C
B
A
1
2
3
4
5
6

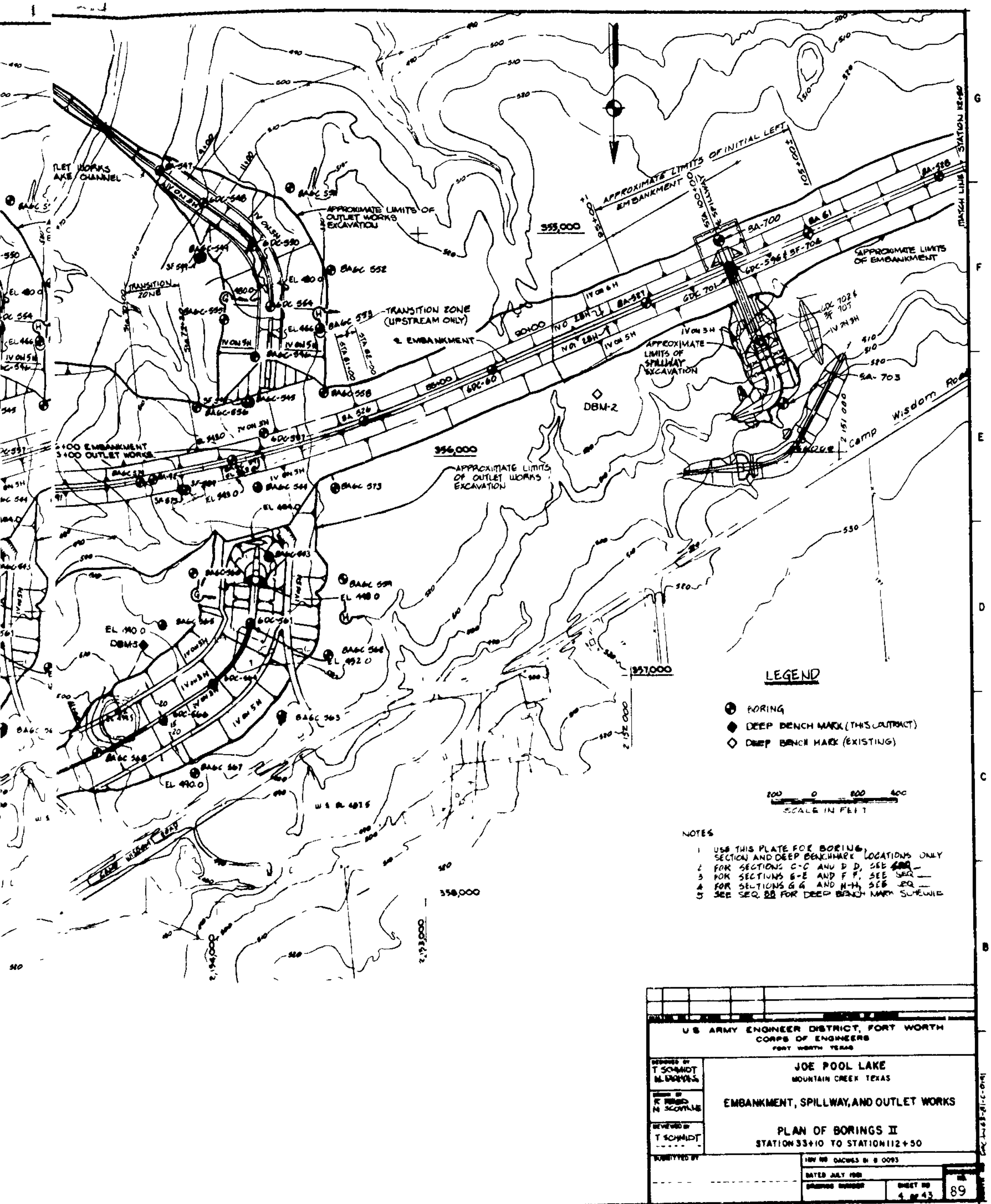
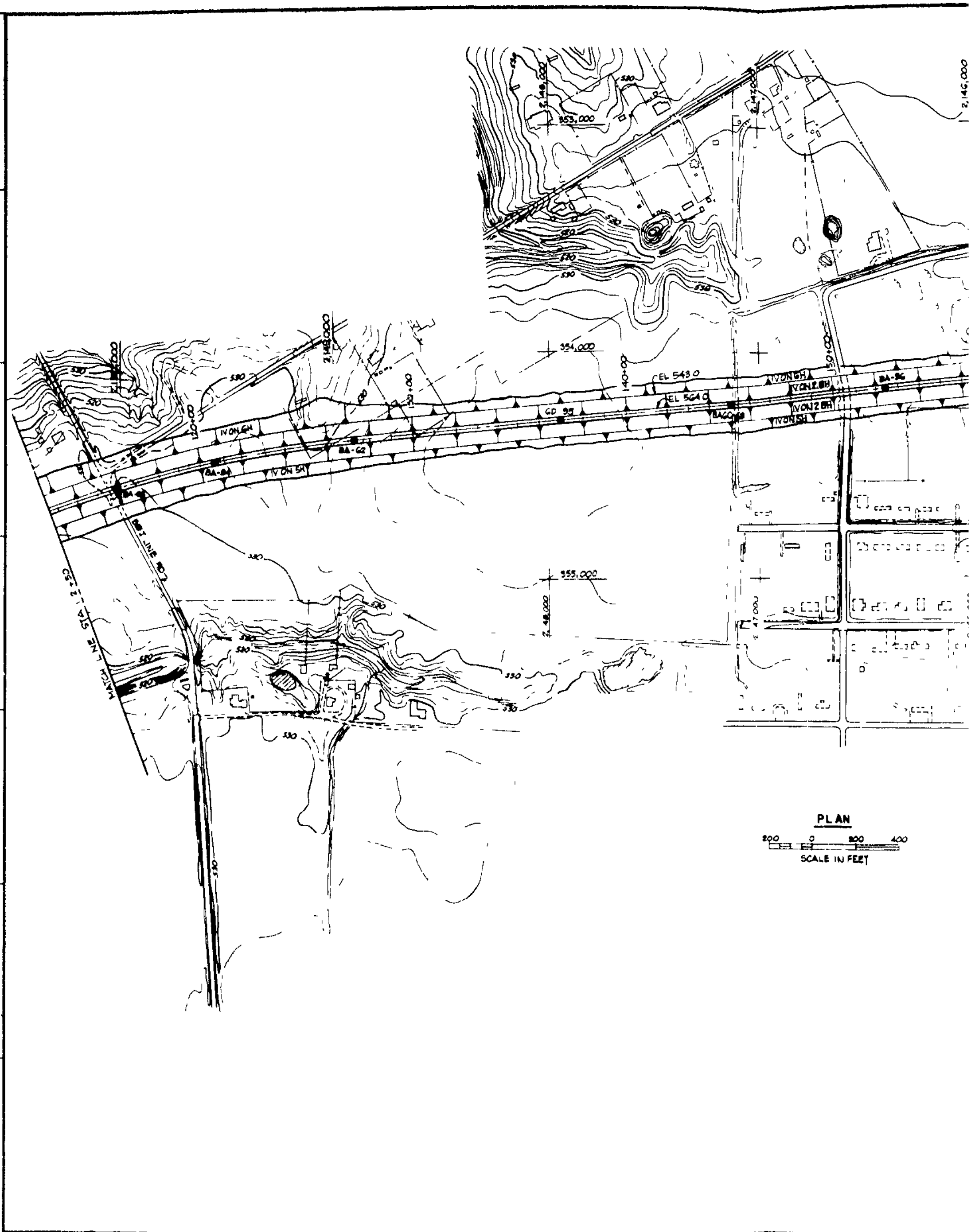
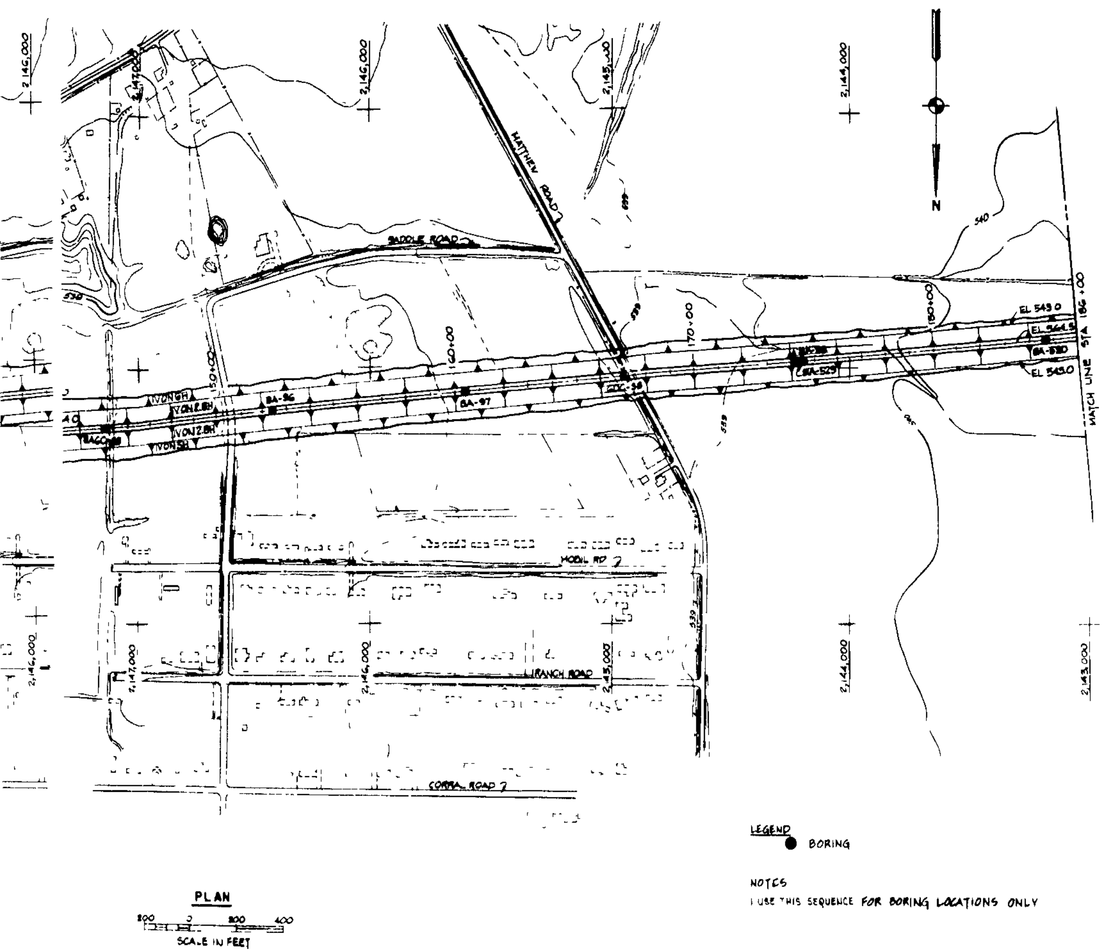

LEGEND
BORING
DEEP BENCH MARK (THIS CONTRACT)
DEEP BENCH MARK (EXISTING)
200 0 200 400
SCALE IN FEET
NOTES
1 USE THIS PLATE FOR BORING, SECTION AND DEEP BENCHMARK LOCATIONS ONLY
2 FOR SECTIONS C-C AND D-D, SEE SEQ —
3 FOR SECTIONS E-E AND F-F, SEE SEQ —
4 FOR SECTIONS G-G AND H-H, SEE SEQ —
5 SEE SEQ 88 FOR DEEP BENCH MARK SCHEDULE
U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS
T SCHMIDT
T SCHMIDT
JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
PLAN OF BORINGS II
STATION 33+10 TO STATION 112+50
DATED JULY
4 of 43
89
APPROXIMATE LIMITS OF INITIAL LEFT EMBANKMENT
APPROXIMATE LIMITS OF OUTLET WORKS EXCAVATION
APPROXIMATE LIMITS OF EMBANKMENT
APPROXIMATE LIMITS OF SPILLWAY EXCAVATION
TRANSITION ZONE (UPSTREAM ONLY)
TRANSITION ZONE
℄ EMBANKMENT
DBM-2
DBM-3
355,000
356,000
357,000
358,000
Camp Wisdom Road
MATCH LINE STATION 112+50

PLATE 34


PLAN
200 0 200 400
SCALE IN FEET
MATCH LINE STA 12+50
353,000
354,000
355,000
2,148,000
2,147,000
2,146,000
2,148,000
120+00
130+00
140+00
150+00
EL 543.0
EL 564.0
GD 99
BA-62
BA-64
BA-96
1 VON 6H
1 VON 5H
1 VON 2.5H
530
520
550
G
F
E
D
C
B
A
1
2
3
4
5
6



LEGEND
● BORING

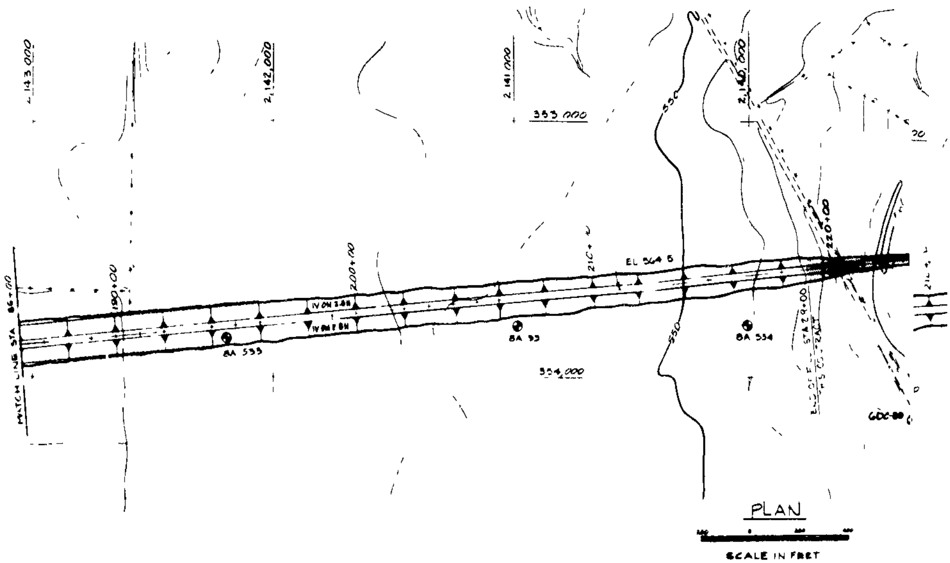
NOTES
1 USE THIS SEQUENCE FOR BORING LOCATIONS ONLY

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T SCHMIDT M NICHOLS	JOE POOL LAKE MOUNTAIN CREEK TEXAS
DRAWN BY M POTTS	EMBANKMENT, SPILLWAY, AND OUTLET WORKS
REVIEWED BY T SCHMIDT	PLAN OF BORINGS III STA 112+50 TO 186+00
SUBMITTED BY	INV NO DACW63-81-B-0095
	DATED JULY 1981
	DRAWING NUMBER — SHEET NO 5 of 43 — SEQUENCE NO. 90

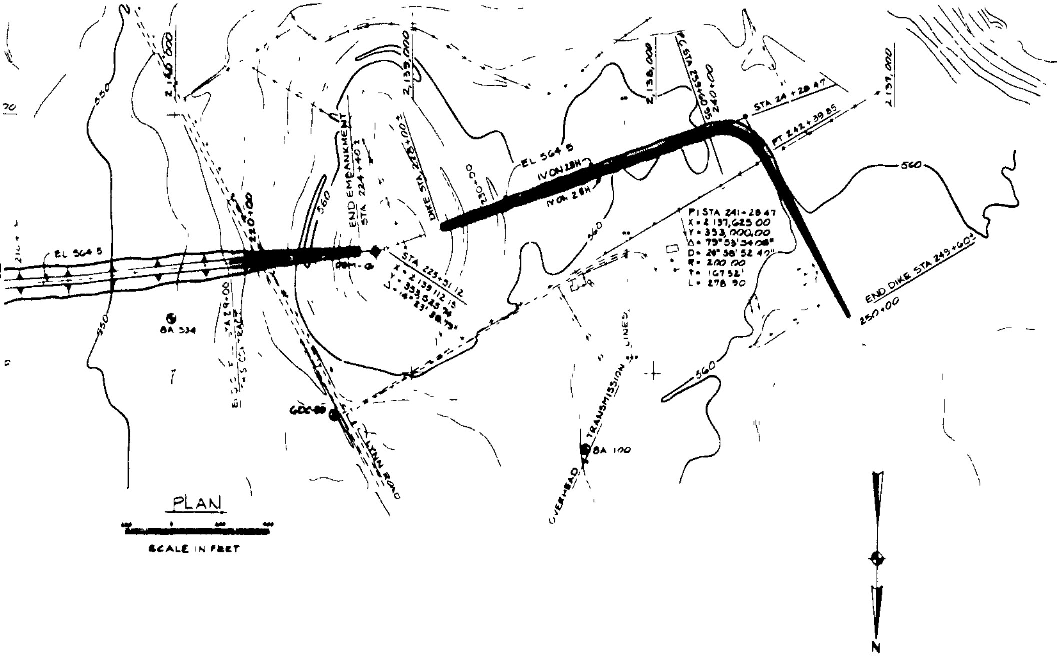
DACW63-81-C-0191

PLATE 35



2 3 4 5 6

G F E D C B A



LEGEND:

- BORING
- DEEP BENCH MARK (THIS CONTRACT)
- FILL (BY OTHERS)

NOTE

1 SEE SEE FOR DEEP BENCH MARK SCHEDULE
2 USE THIS SEQUENCE FOR BORING AND DEEP BENCH MARK LOCATIONS ONLY

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T SCHMIDT, M NICHOLS
DRAWN BY M POTTS
REVIEWED BY T SCHMIDT
SUBMITTED BY

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

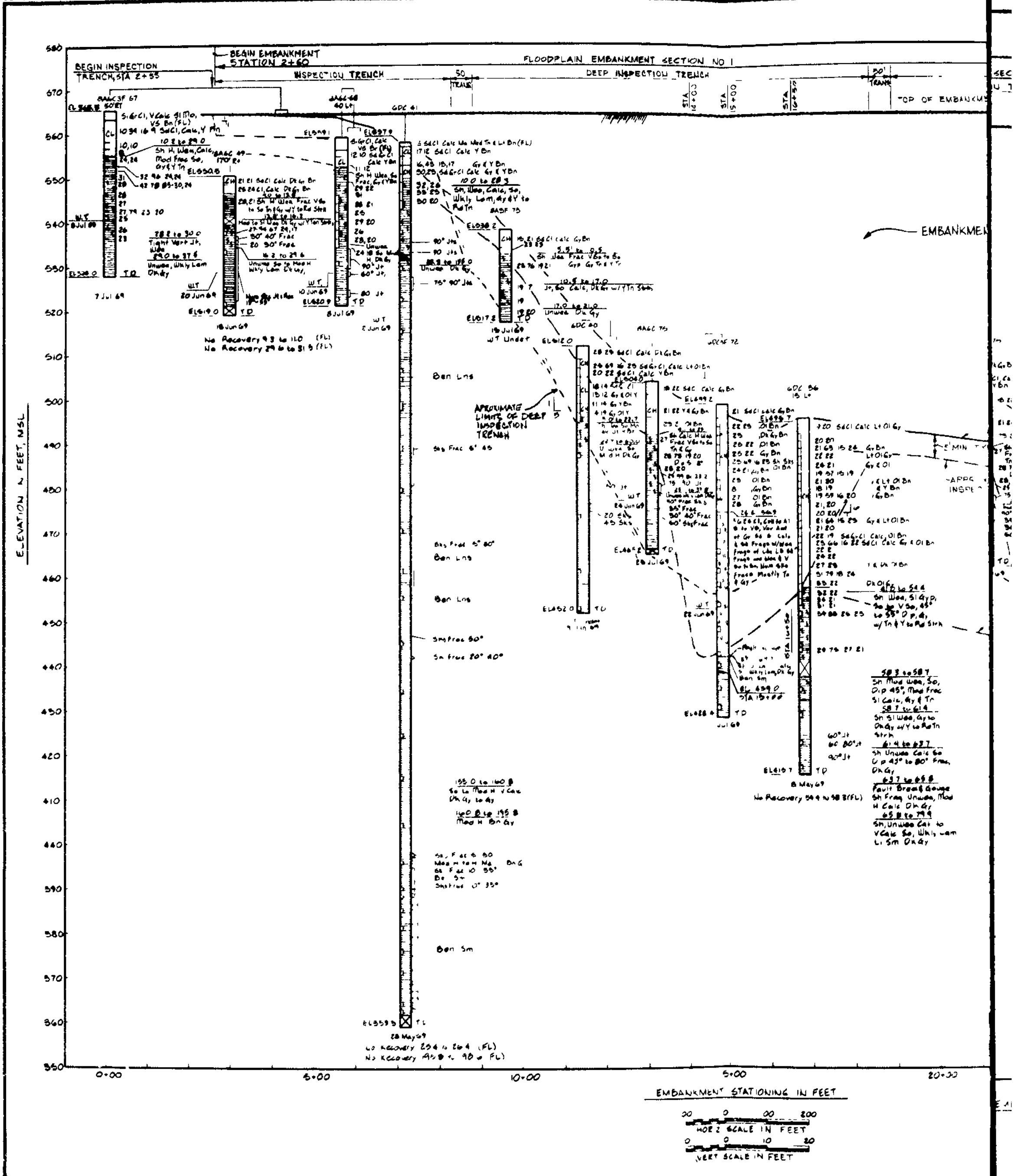
EMBANKMENT, SPILLWAY, AND OUTLET WORKS

PLAN OF BORINGS III
STATION 196+00 TO 242+60

DATED JULY 1981
SHEET NO 6 of 43
91

PLATE 36

CORPS OF ENGINEERS



US ARMY

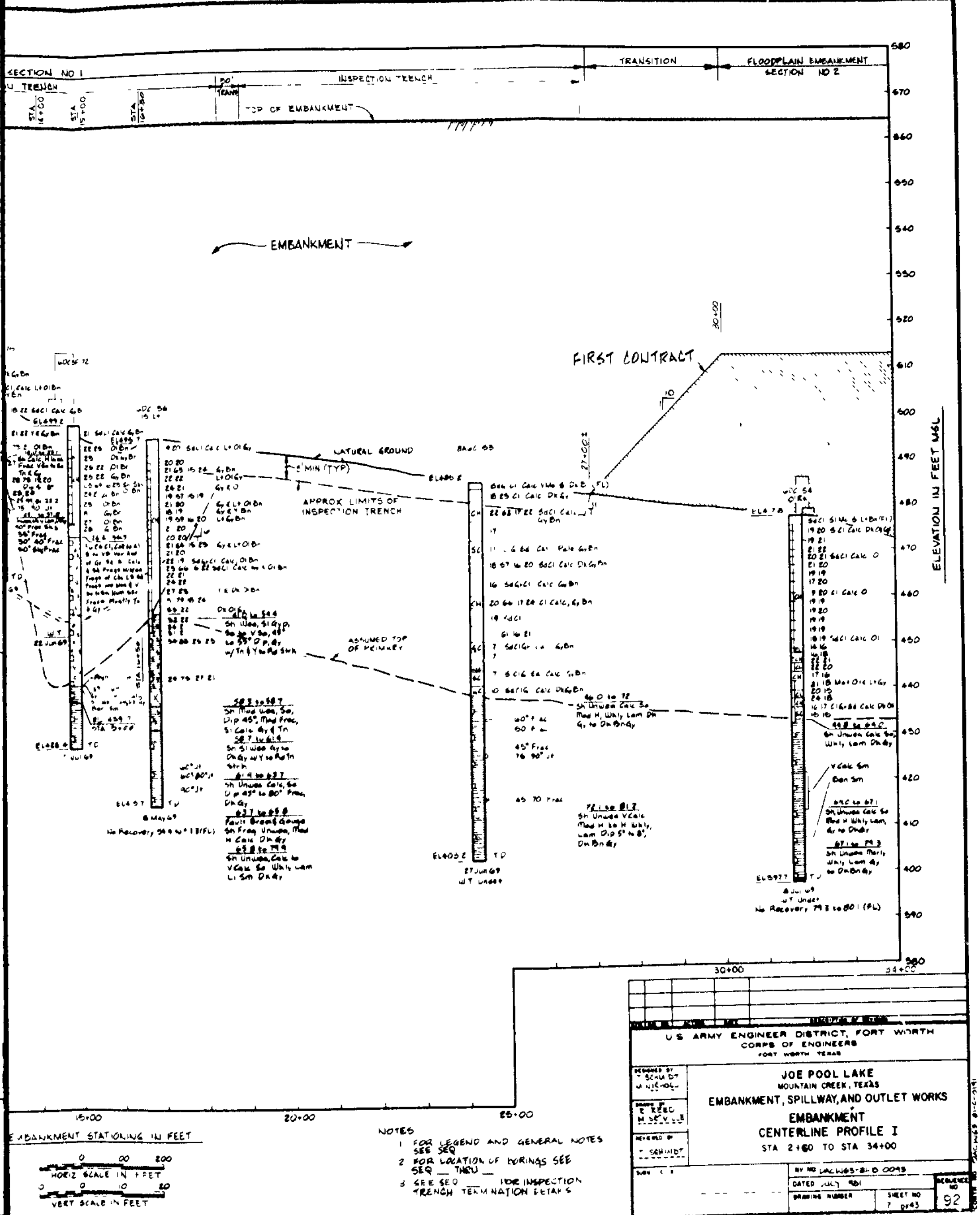
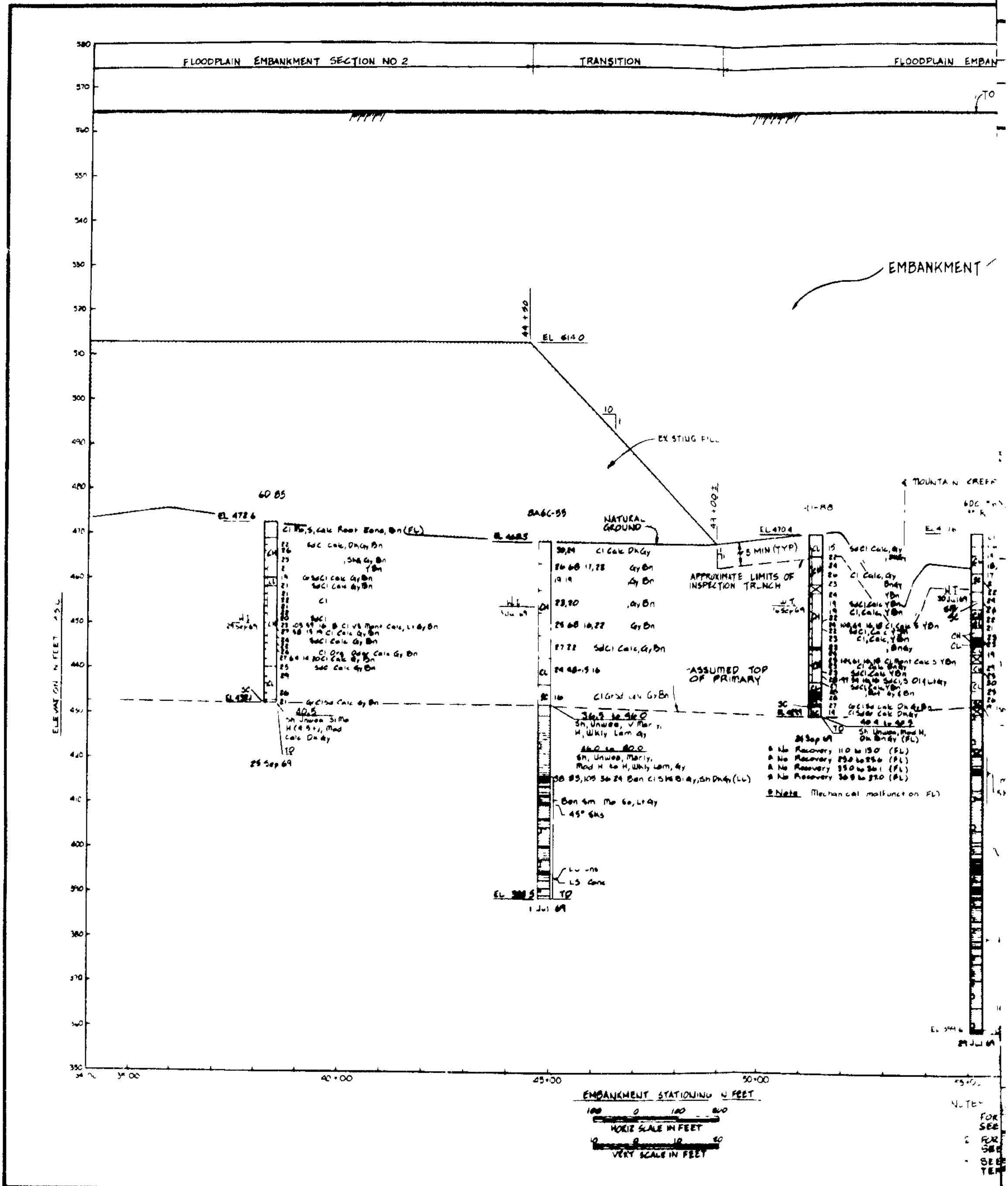
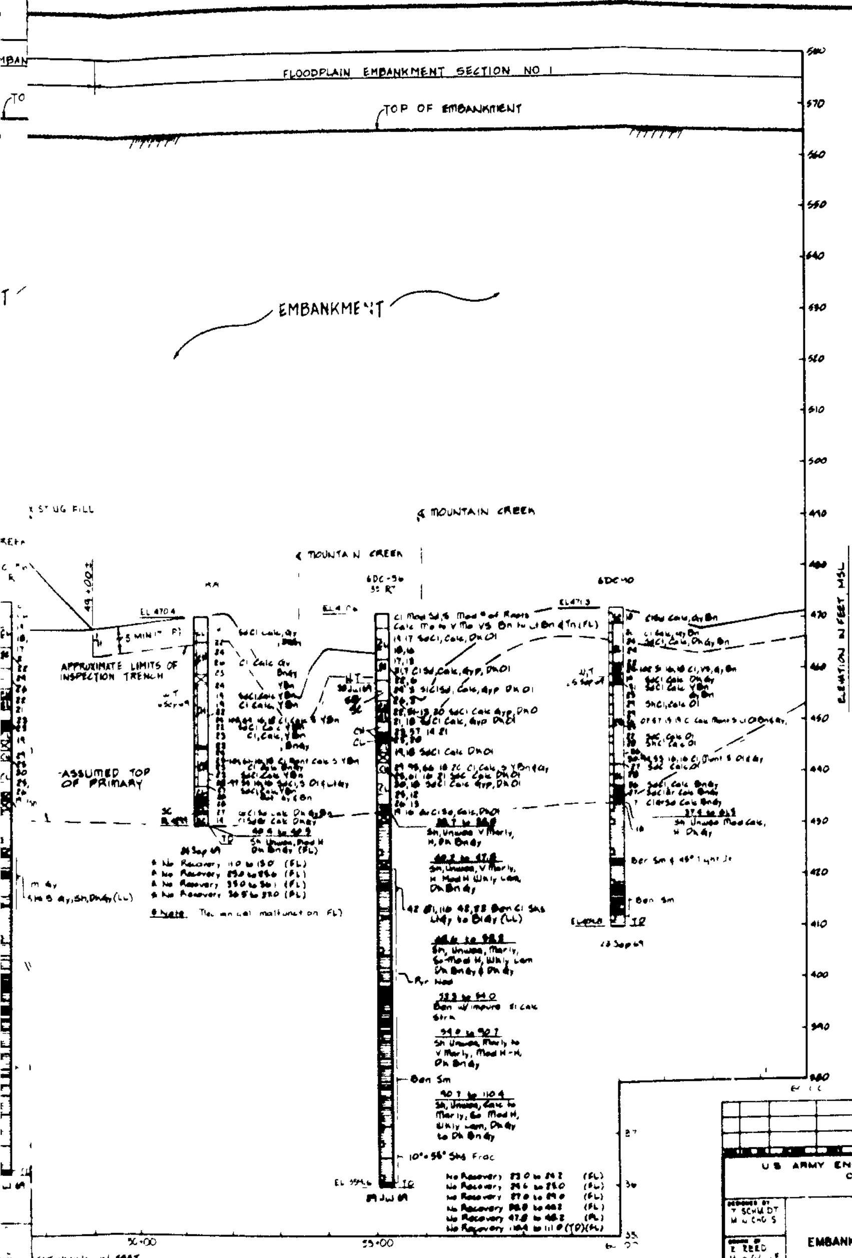


PLATE 37



FLOODPLAIN EMBANKMENT SECTION NO 2
TRANSITION
FLOODPLAIN EMBAN
EMBANKMENT
EL 514.0
EXISTING FILL
NATURAL GROUND
5 MIN (TYP)
APPROXIMATE LIMITS OF INSPECTION TRENCH
ASSUMED TOP OF PRIMARY
EL 472.6
EL 470.4
EL 398.5
1 Jul 69
25 Sep 69
26 Sep 69
No Recovery 11.0 to 15.0 (FL)
No Recovery 25.0 to 25.6 (FL)
No Recovery 35.0 to 36.1 (FL)
No Recovery 36.9 to 37.0 (FL)
Note Mechanical malfunction (FL)
ELEVATION IN FEET MSL
EMBANKMENT STATIONING IN FEET
HORIZ SCALE IN FEET
VERT SCALE IN FEET
40+00
45+00
50+00
NOTES



NOTES

1. FOR LEGEND AND GENERAL NOTES SEE SEQ
2. FOR BORING LOCATIONS SEE SEQ
3. SEE SEQ FOR INSPECTION TRENCH TERMINATION DETAILS

U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

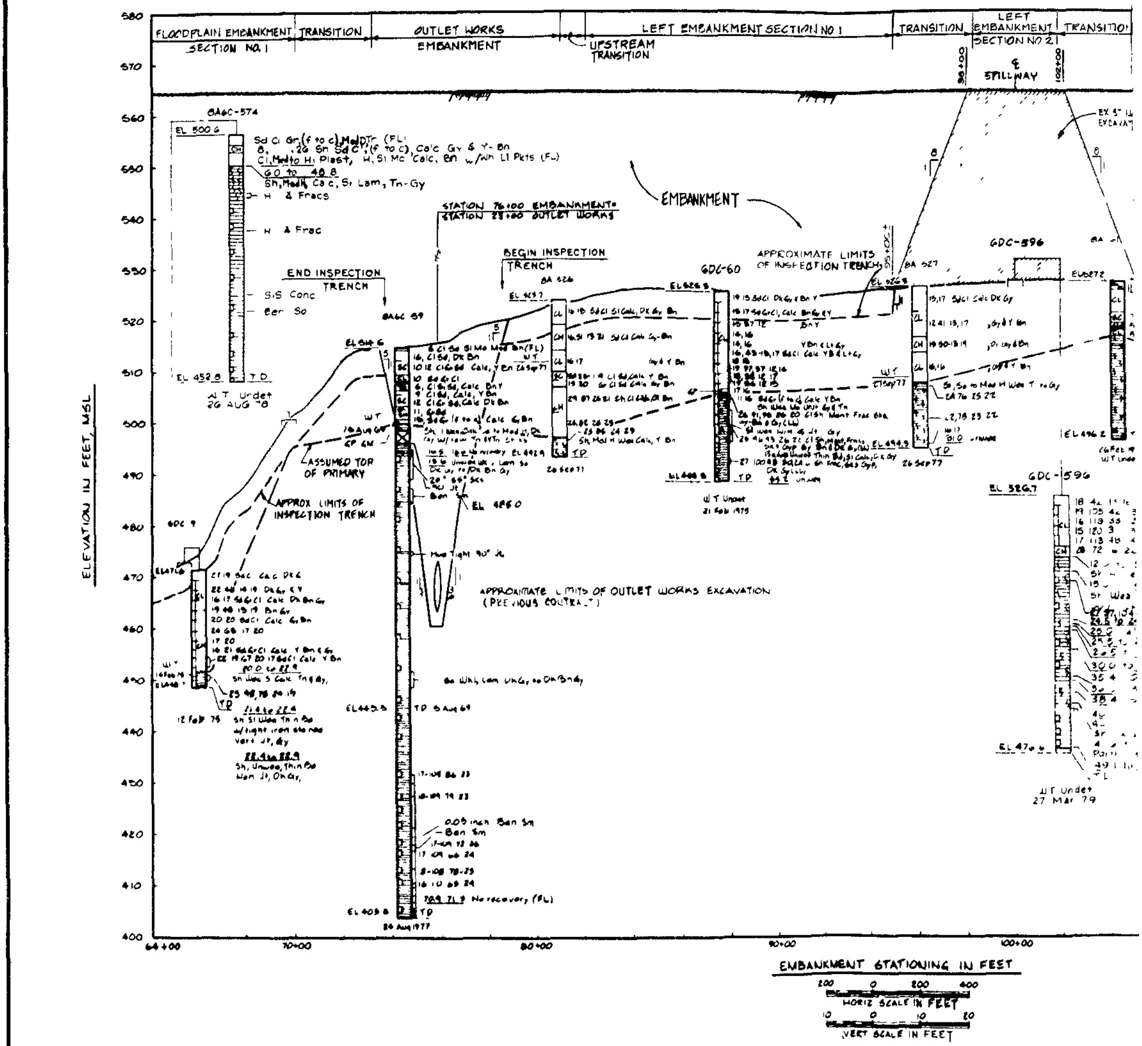
EMBANKMENT, SPILLWAY, AND OUTLET WORKS

EMBANKMENT
CENTERLINE PROFILE II
STA 34+00 TO STA 84+00

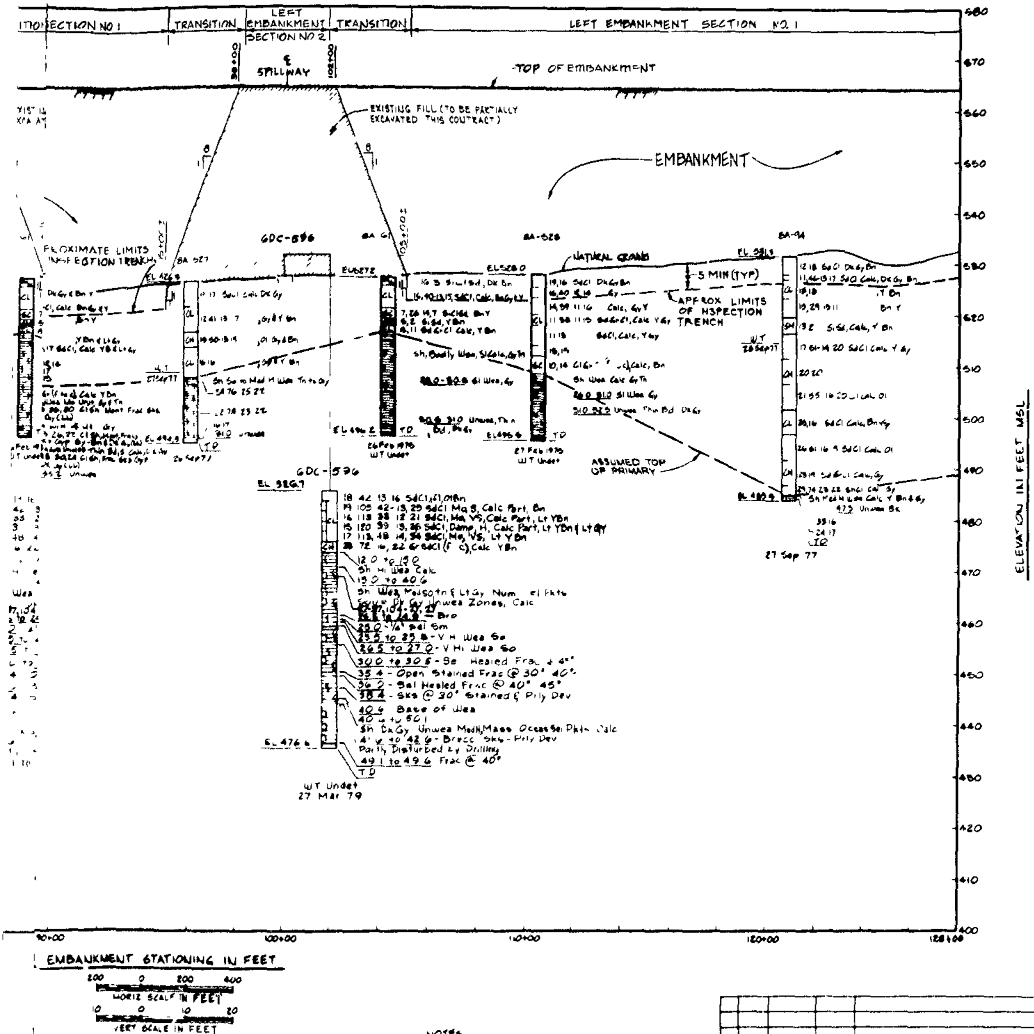
DATED JULY 1981

93

PLATE 38


FLOODPLAIN EMBANKMENT SECTION NO. 1
TRANSITION
OUTLET WORKS EMBANKMENT
UPSTREAM TRANSITION
LEFT EMBANKMENT SECTION NO 1
TRANSITION
LEFT EMBANKMENT SECTION NO 2
TRANSITION
STILLWAY
EMBANKMENT
STATION 76+00 EMBANKMENT= STATION 23+00 OUTLET WORKS
BEGIN INSPECTION TRENCH
END INSPECTION TRENCH
APPROXIMATE LIMITS OF INSPECTION TRENCH
ASSUMED TOP OF PRIMARY
APPROX LIMITS OF INSPECTION TRENCH
APPROXIMATE LIMITS OF OUTLET WORKS EXCAVATION (PREVIOUS CONTRACT)
ELEVATION IN FEET, MSL
EMBANKMENT STATIONING IN FEET
HORIZ SCALE IN FEET
VERT SCALE IN FEET
GDC-60
GDC-596
BAGC-574
EL 500.6
EL 452.8
W.T. Undet 26 AUG 78
W.T. Undet 27 Mar 79
W.T. Undet 21 Feb 1975

US ARMY



NOTES

1. FOR GENERAL NOTES AND LEGEND SEE SEQ ___
2. FOR BORING LOCATIONS SEE SEQ 88 THRU SEQ ___
3. SEE SEQ ___ FOR LIMITS OF OUTLET WORKS EXCAVATION
4. SEE SEQ ___ FOR INSPECTION TRENCH TERMINATION DETAILS
5. STATION 10+00 SPILLWAY = STATION 100+00 EMBANKMENT

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

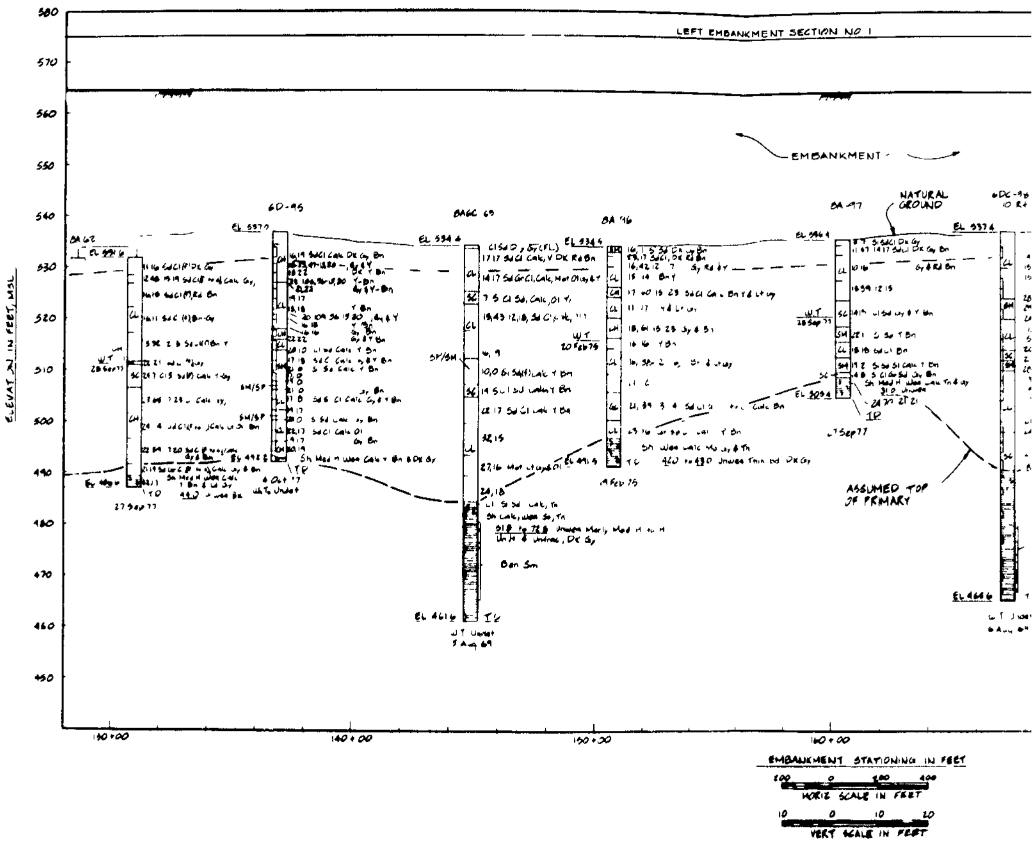
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT, SPILLWAY AND OUTLET WORKS
EMBANKMENT
CENTERLINE PROFILE II
STA 64+00 TO STA 128+00

DESIGNED BY	T. SCHMIDT, M. NICHOLS
DRAWN BY	R. REED, M. NICHOLS
REVIEWED BY	T. SCHMIDT
SUBMITTED BY	
INV NO	DACW63 81 B 0098
DATED	JULY 1981
SHEET NO	9 of 43
SEQUENCE NO	94

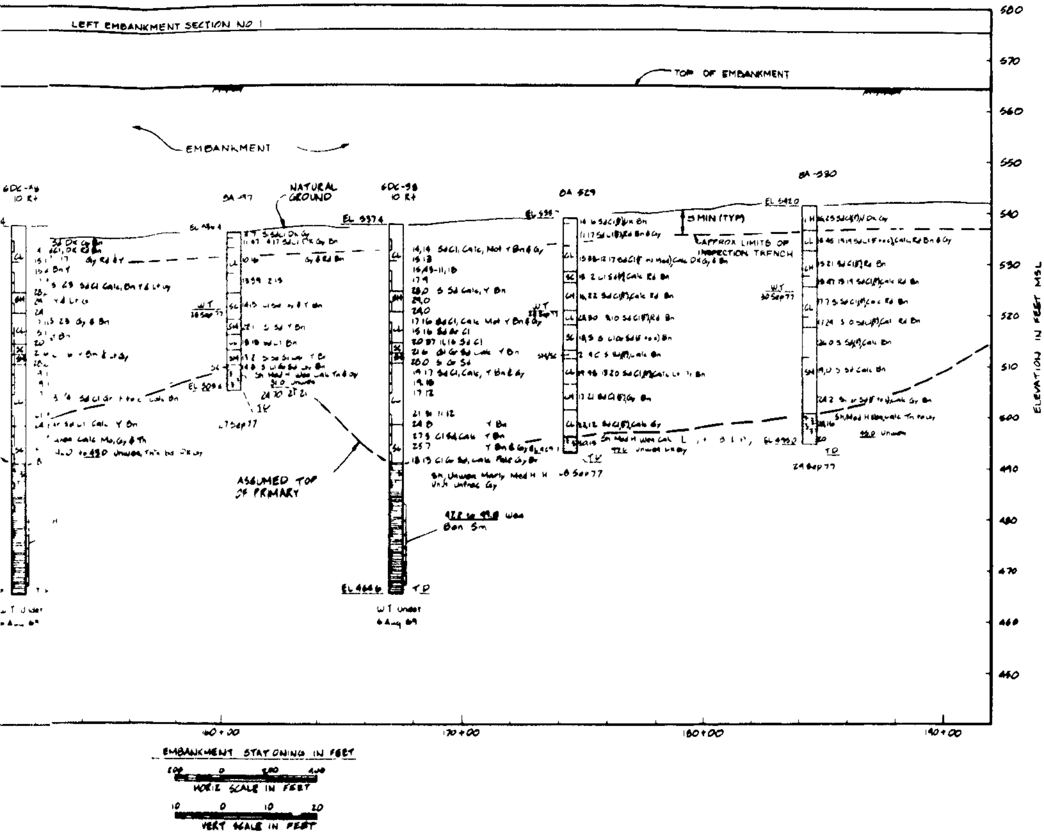
DACW63-81-B-0098

PLATE 39

CORPS OF ENGINEERS



US ARMY



NOTES
1 FOR GENERAL NOTES AND LEGEND SEE SEQ
2 FOR BORING LOCATIONS SEE SEQ THRU SEQ

U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

T SCHMIDT
M NICHOLS

E REED
M SCOVILLE

T SCHMIDT

JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
EMBANKMENT
CENTERLINE PROFILE IV
STATION 128+00 TO STATION 192+00

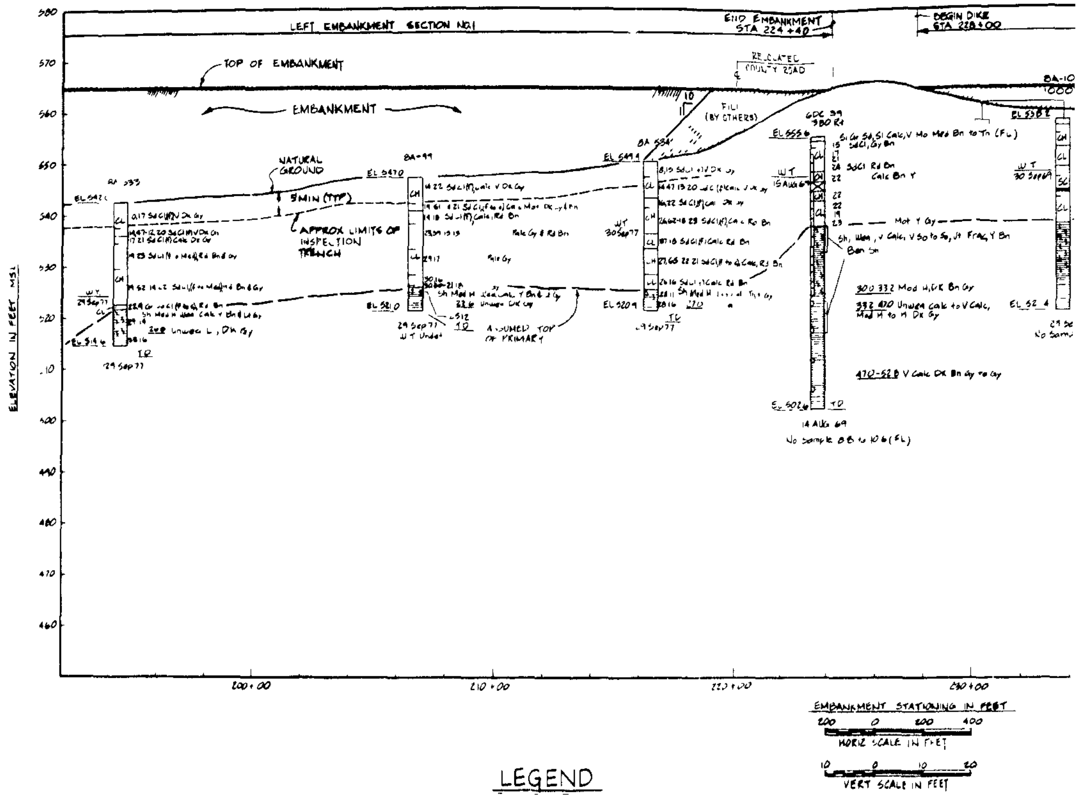
DATED JULY 1981

SHEET 10 of 43

95

PLATE 40

CORPS OF ENGINEERS



LEGEND

VISUAL CLASSIFICATION

Coll	Colluvium
Var	Variable
Sd	Sand or Sandy
Cl	Clay or Clayey
S	Silt or Silty
Sh	Shale or Shaley
Gr	Gravel or Gravelly
Cong	Conglomerate
LS	Limestone
Lns	Lenses
Sm	Seam or Seams
Frac	Fractures or Fractured
Brecc	Brecciated
Dip	Dipping
Frag	Fragments or Fragmented
Jt	Joints or Jointed
Sks	Slickensided
Calc	Calcareous
Gyp	Gypsiferous
Sl	Slight or Slightly
S	Stiff
Conc	Concretion
V	Very
L	Lime or Limy
W/	With
H	High or Highly
Vert	Vertical
(FL)	Field log
LL	Lab log
F	Fine
C	Coarse
Strk	Streaks
Ben	Bentonite
Pyr	Pyrite
Mont	Montmorillonite
Al	Alluvium
Num	Numerous
Wh	White
Cha	Chalk or Chalky
Mass	Massive
P	Poorly

Amt	Amount
Con	Consist
So	Soft
VSo	Very soft
H	Hard
Mot	Mottled
Wea	Weathered
Unwea	Unweathered
WT	Water Table
WT Undet	Water Table Undetermined
Dev	Developed
Nod	Nodules
Cal	Caliche
Gent	Gently
Mod	Moderately
Y	Yellow
Bn	Brown
Gy	Gray
Lt	Light
Dk	Dark
Tn	Tan
TD	Total Depth
Ol	Olive
Sat	Saturated
Med	Medium
Scat	Scattered
Bro	Broken
Lam	Laminated
SS	Siltstone
Bk	Black
No Wtr Enc	No Water Encountered
Rd	Red
Foss	Fossiliferous
Mo	Moist
Rnd	Rounded
Pkts	Pockets
Bd	Bedding or Bedded
Cem	Cemented or Cementation
Po	Pocketed
A	Angle

Gr	Green
Pyr	Pyrite or Pyritic
Int	Intersecting
Alt	Alternating
Plast	Plasticity
Predom	Predominately
Part	Particle or Particles
Occas	Occasional
Unjt	Unjointed
Unfrac	Unfractured
VS	Very stiff
Sel	Selenite
Wkly	Weakly
Org	Organic
Bl	Blue
D	Dense

LABORATORY CLASSIFICATION

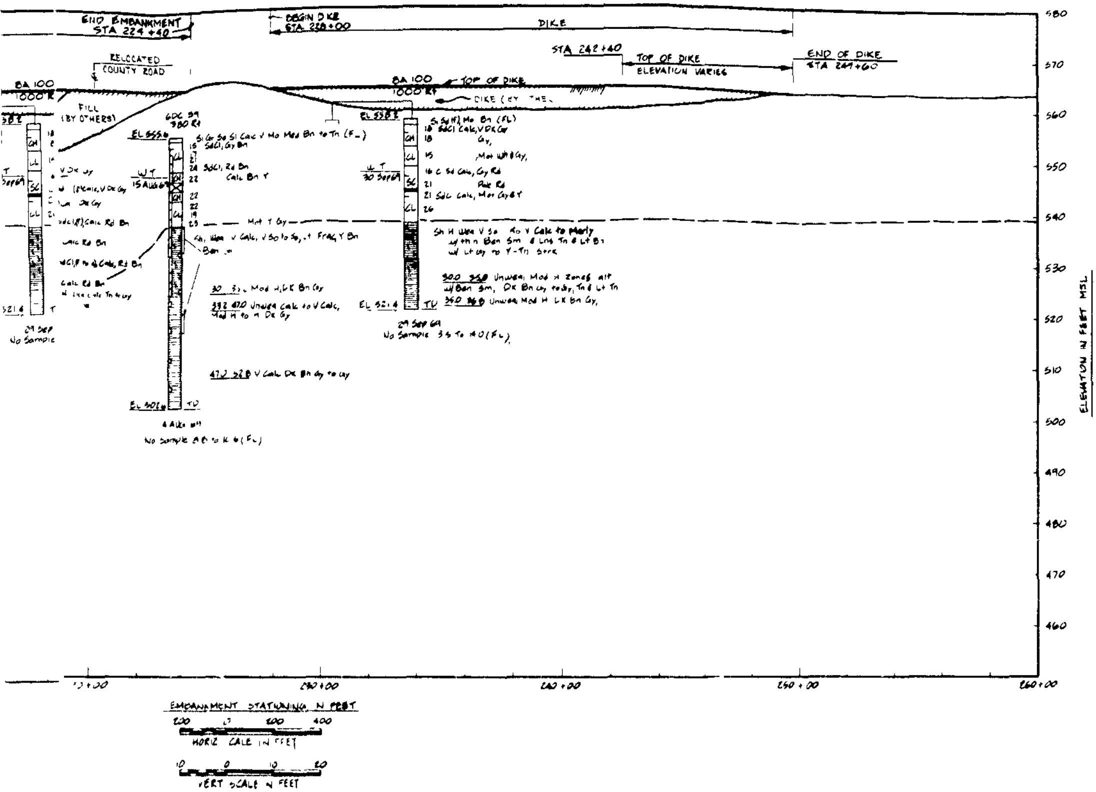
GC	Clayey gravels gravel sand clay mixtures
SM	Silty sands sand silt mixtures
SC	Clayey sands sand clay mixtures
CL	Inorganic clays of low plasticity gravelly clays sandy clays silty clays lean clays
CH	Inorganic clays of high plasticity fat clays
GP	Poorly Graded gravels Gravel Sand Mixtures, little or no fines
GM	Silty gravels, gravel sand-silt mixtures
SP	Poorly graded sands gravelly sands, little or no fines

STATIGRAPHIC CLASSIFICATION

SHALE Wea

SHALE, Unwea

No Recovery



LABORATORY CLASSIFICATION

GC	Clayey gravels gravel sand clay mixtures
SM	Silty sands sand silt mixtures
SC	Clayey sands sand clay mixtures
CL	Inorganic clays of low plasticity gravelly clays sandy clays silty clays lean clays
CH	Inorganic clays of high plasticity fat clays
GP	Poorly Graded gravels Gravel Sand Mixtures, Little or no fines
GM	Silty gravels, gravel sand silt mixtures
SP	Poorly graded sands gravelly sands, little or no fines

STATIGRAPHIC CLASSIFICATION

SHALE Wea

SHALE Unwea

GENERAL NOTES

1. Absence of ground water levels opposite boring logs does not necessarily mean that ground water will not be encountered at the location or within the vertical reaches of the borings
2. [illegible] LOGS [illegible] WATER CONTENTS [illegible] PERCENT OF THE DRY WEIGHT [illegible] LIMIT [illegible] SHRINKAGE [illegible] EXAMPLE [illegible]
3. The date the boring was completed is shown at the bottom of the log
4. Overburden descriptions are in accordance with laboratory test results (Lab logs) unless otherwise indicated Primary descriptions are in accordance with field logs unless otherwise indicated
5. The bar linear shrinkage (BLS) test yields a percent shrinkage that correlates approximately with the liquid limit
6. Top of embankment elevations shown do not reflect overbuild
7. The natural ground profiles shown are interpolations and extrapolations of available elevation data Minor differences may exist between elevations shown and actual ground elevations
8. NO GRAVEL, SAND, OR SILT IS MENTIONED IN THE OVERBURDEN DESCRIPTIONS UNLESS THE TEST RESULTS INDICATED THE SAMPLE TESTED CONTAINED > 3%, 8%, AND 6%, RESPECTIVELY
9. FOR BORING LOCATIONS SEE SEQ __ THRU SEQ __

b	AM #0002	JUL 8_	REVISED TO REFLECT M I CHANGES

US ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY
DRAWN BY
REVIEWED BY
SUBMITTED BY

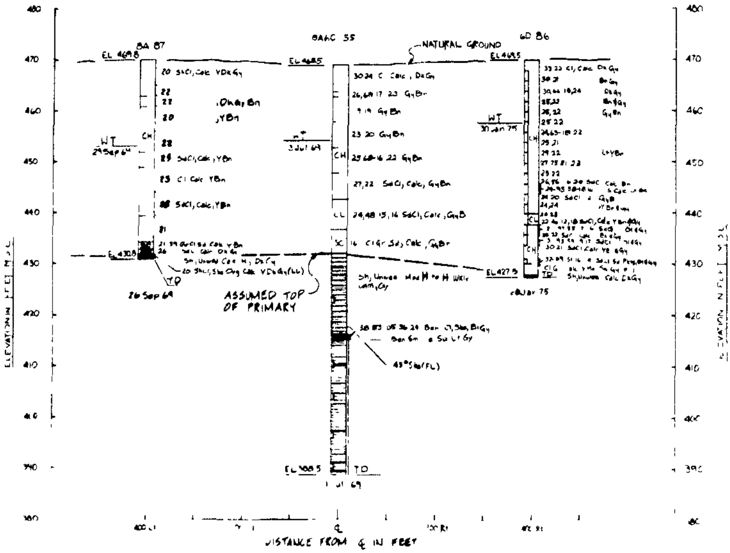
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

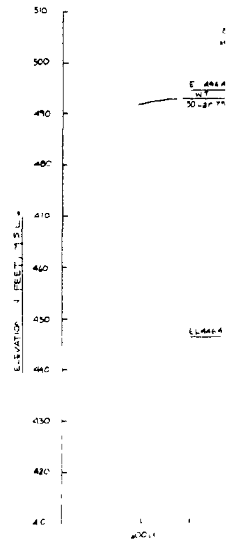
EMBANKMENT
CENTERLINE PROFILE V
STATION 192+00 TO STATION 249+60

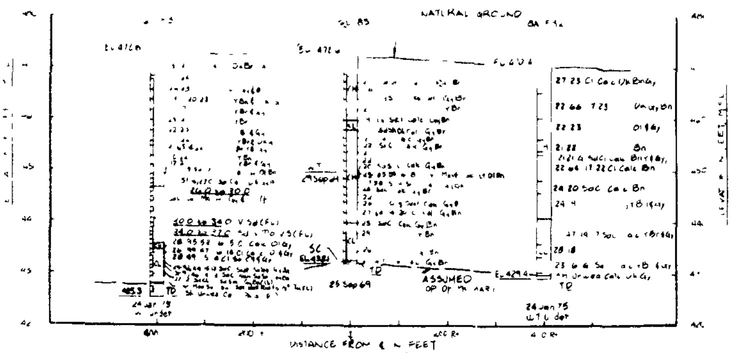
INV NO
DATED JULY 1981
DRAWING NUMBER
SHEET NO 11 of 43
SEQUENCE NO. 96

CORPS OF ENGINEERS

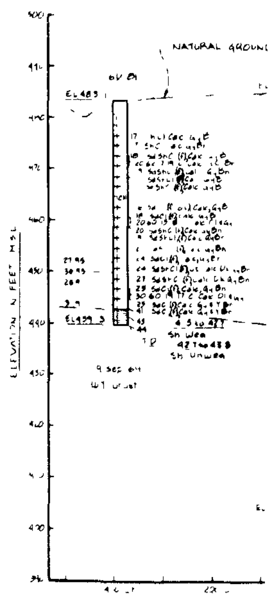


SECTION D D @ STATION 45+00



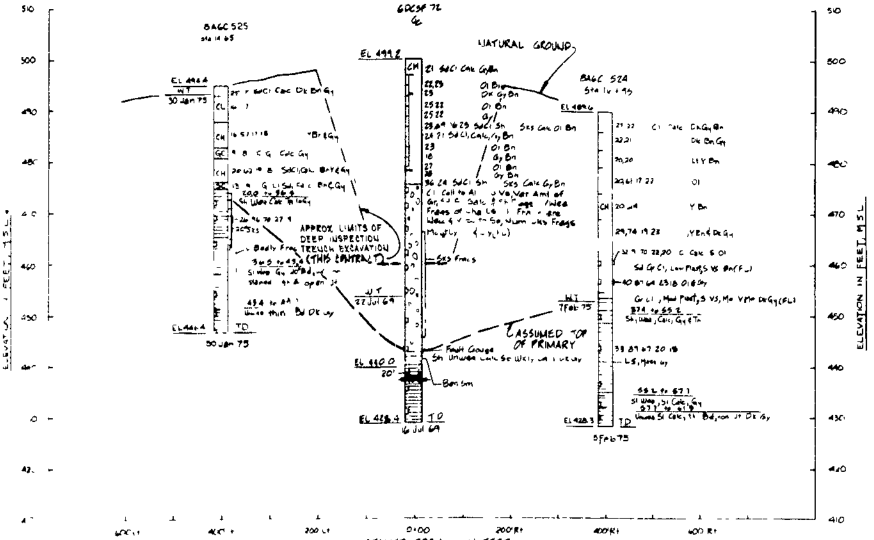


SECTION C C @ STATION 38+50

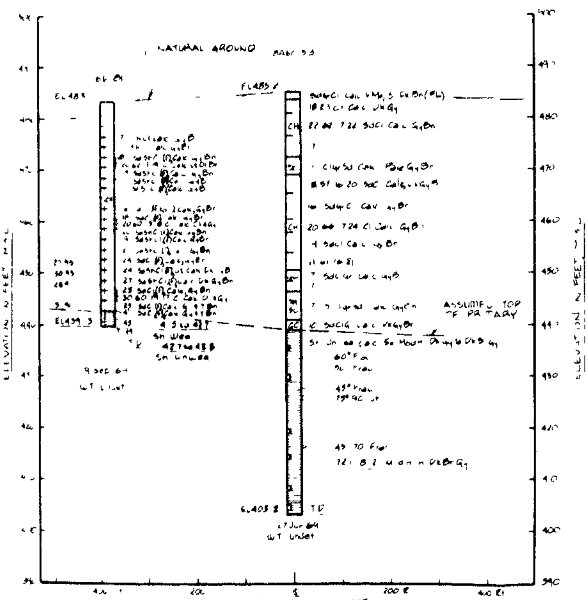


SECTION

US ARMY



SECTION A-A @ STATION 14+00



SECTION B-B @ STATION 24+20

NOTES

1. FOR GENERAL NOTES AND LEGEND SEE SH. ___
2. FOR LOCATION OF SECTIONS SEE SEC ___ AND ___
3. INSPECTION TRENCH SHOWN ON SECTION A-A ONLY

SCALE IN FEET

HORIZ SCALE: 200 0 100 200

VERT SCALE: 20 0 10 20

US ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

EMBANKMENT SECTIONS
A-A, B-B, C-C AND D-D

INV NO DACW63-81 B-0098

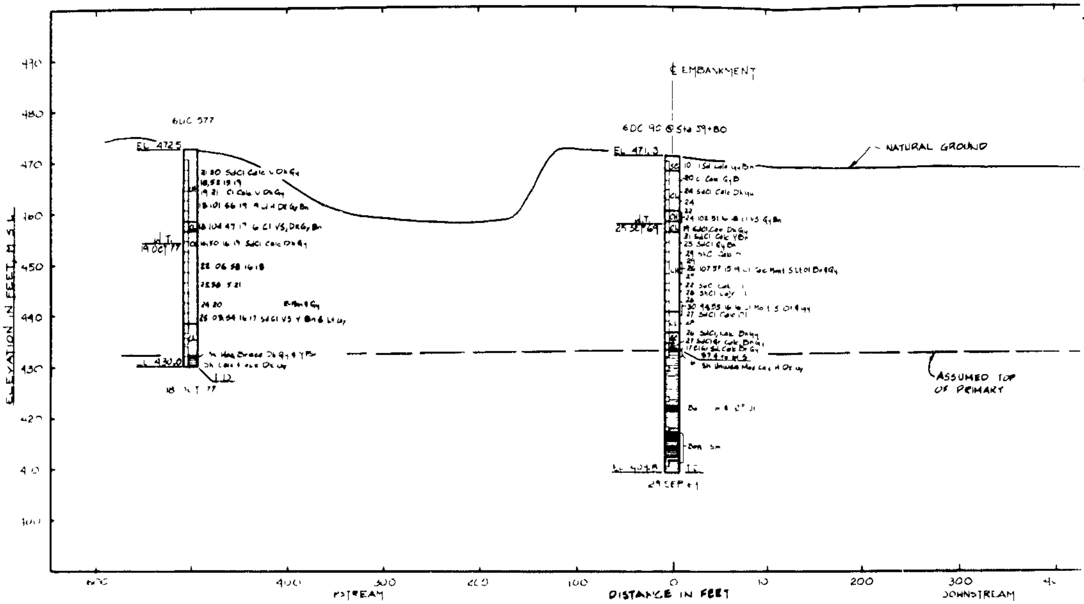
DATED JULY 1981

SHEET NO 12 of 43

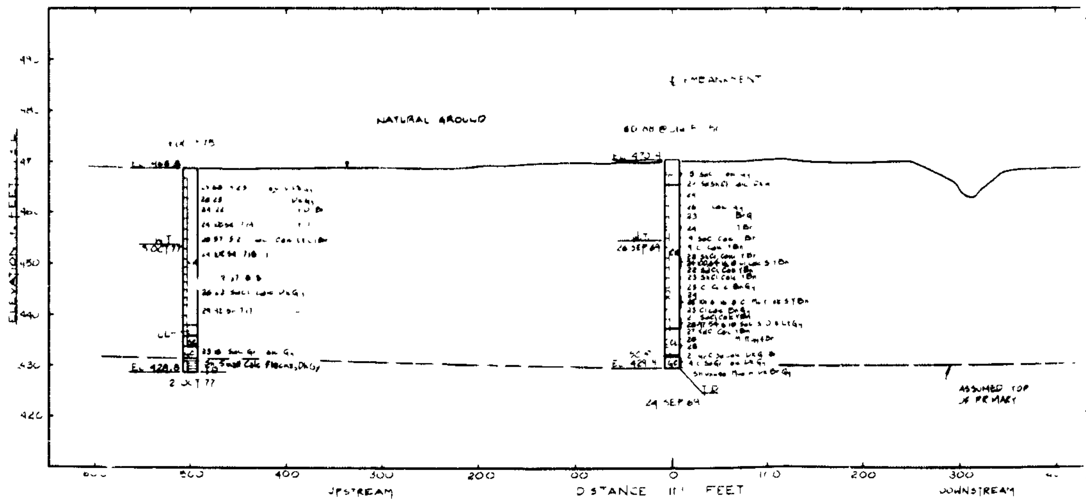
SEQUENCE NO 97

PLATE 42

CORPS OF ENGINEERS

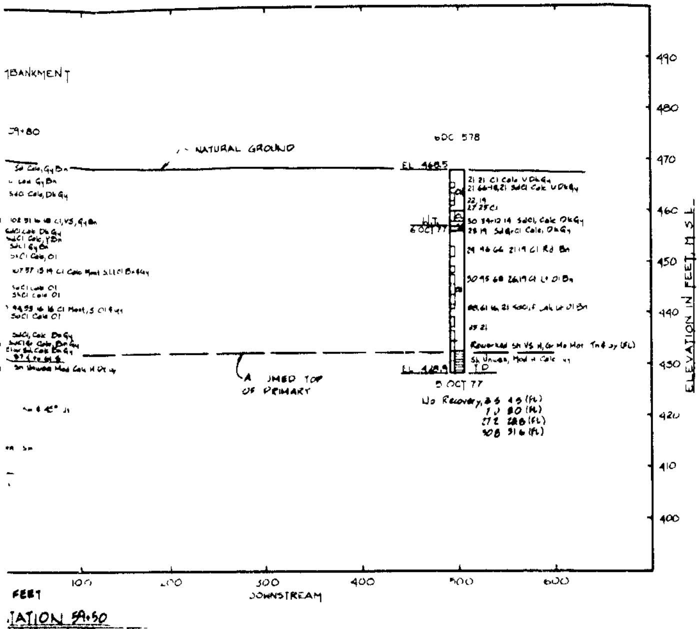


SECTION F-F @ STATION 59+50

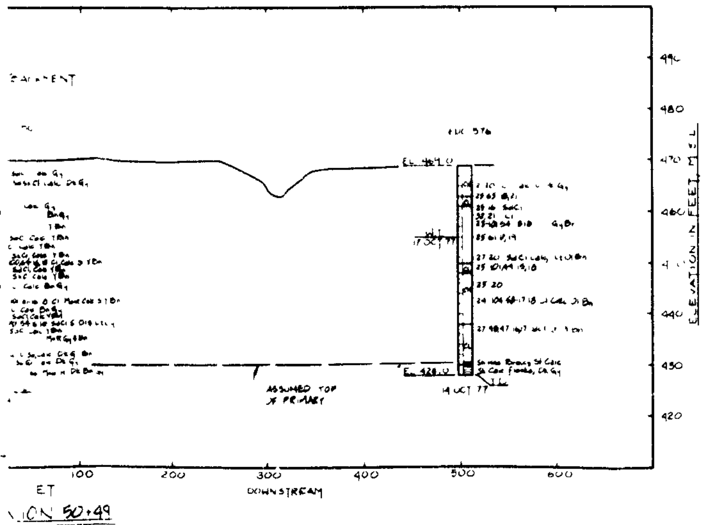


SECTION E-E @ STATION 50+49

US ARMY

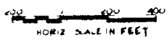


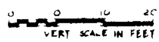
ATION 59+50



ION 50+49

NOTES
1. FOR LEGEND AND GENERAL NOTES SEE SEC
2. FOR LOCATION OF SECTIONS SEE SEQ
3. INSPECTION TRENCH NOT SHOWN





U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T SCHMIDT
DRAWN BY M SLOVER
REVIEWED BY T SCHMIDT
SUBMITTED BY

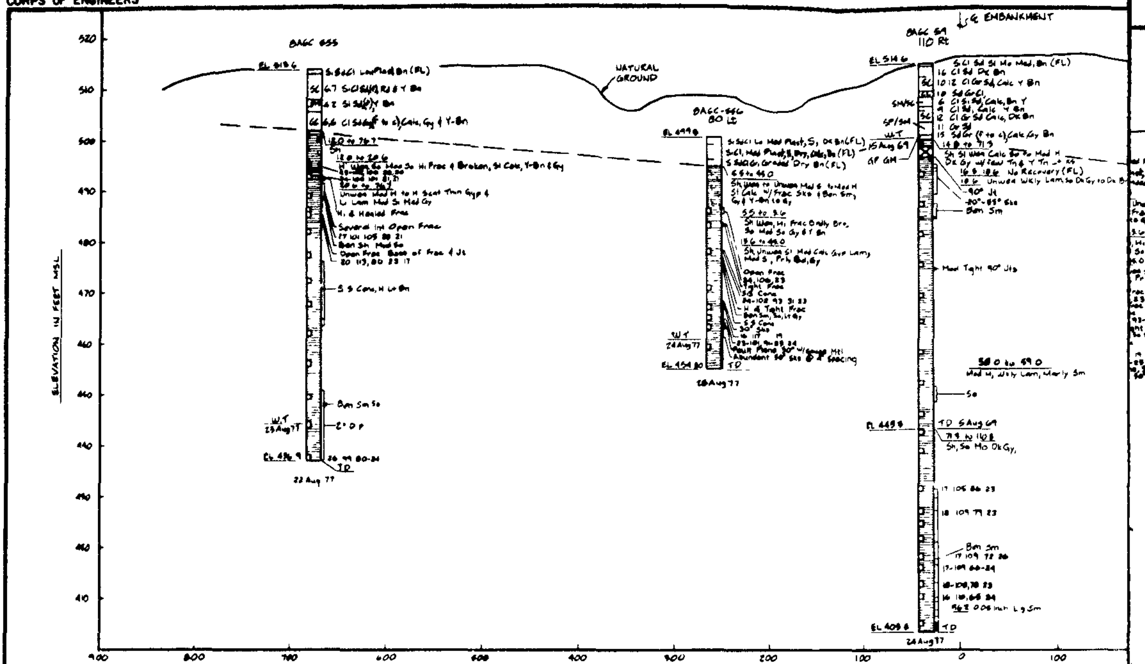
JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

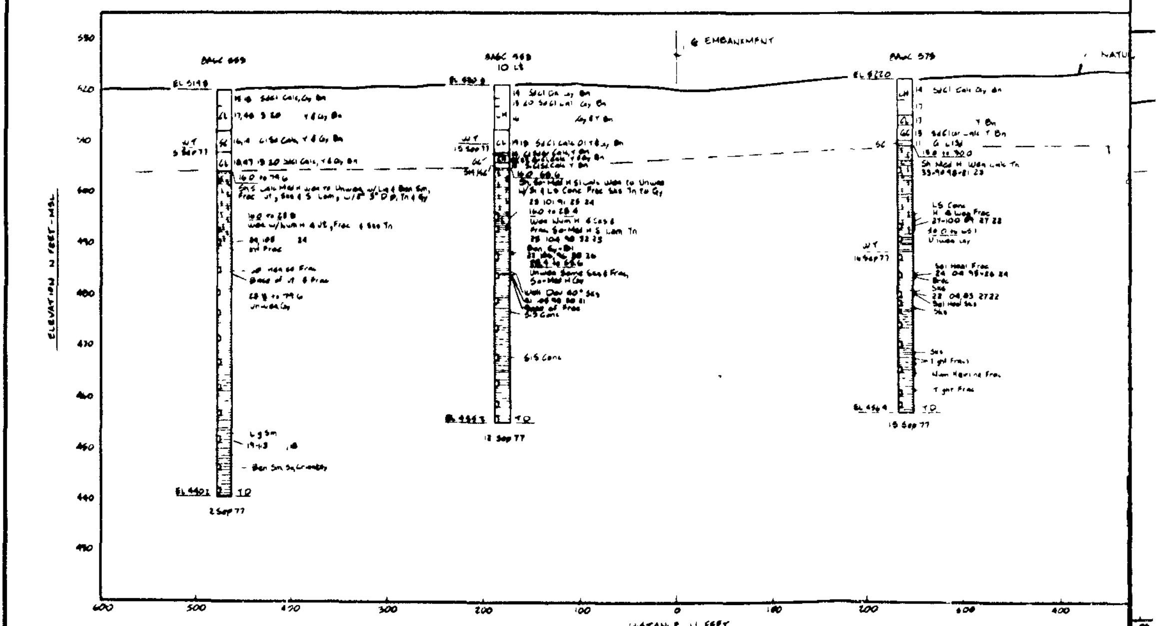
EMBANKMENT SECTIONS
E-E AND F-F

DATED JULY 1981
SHEET NO 13 of 43
98

PLATE 43

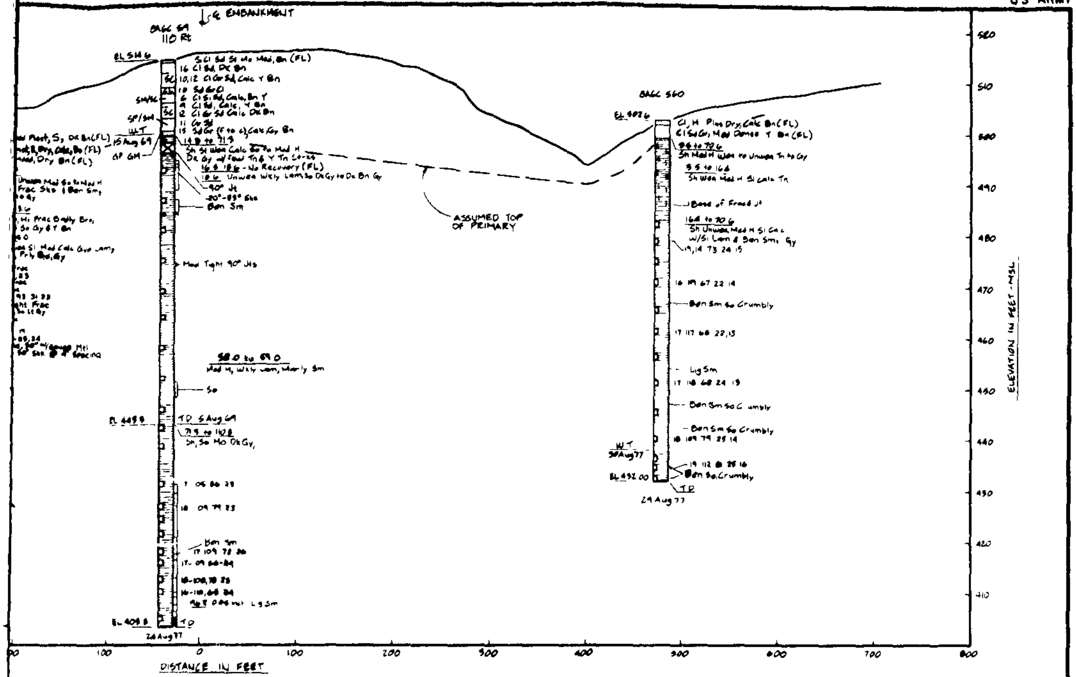


SECTION G-G @ STATION 73+10

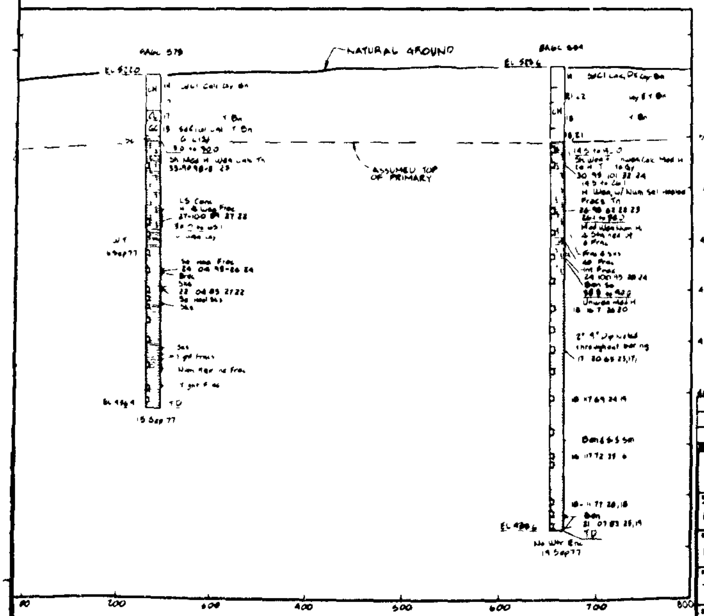


SECTION H-H @ STATION 79+30

US ARMY



SECTION G-G @ STATION 73+10



79+30

NOTES

1. SEE SEQ ___ FOR LEGEND AND GENERAL NOTES
2. SEE SEQ ___ FOR LOCATION OF SECTIONS
3. INSPECTION TRENCH NOT SHOWN

HORZ SCALE IN FEET

VERT SCALE IN FEET

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T. SCHMIDT, H. NICHOLS

DRAWN BY E. REED, H. SCHULZE

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

EMBANKMENT SECTIONS
G-G AND H-H

INV NO DACW63-81-B-0093

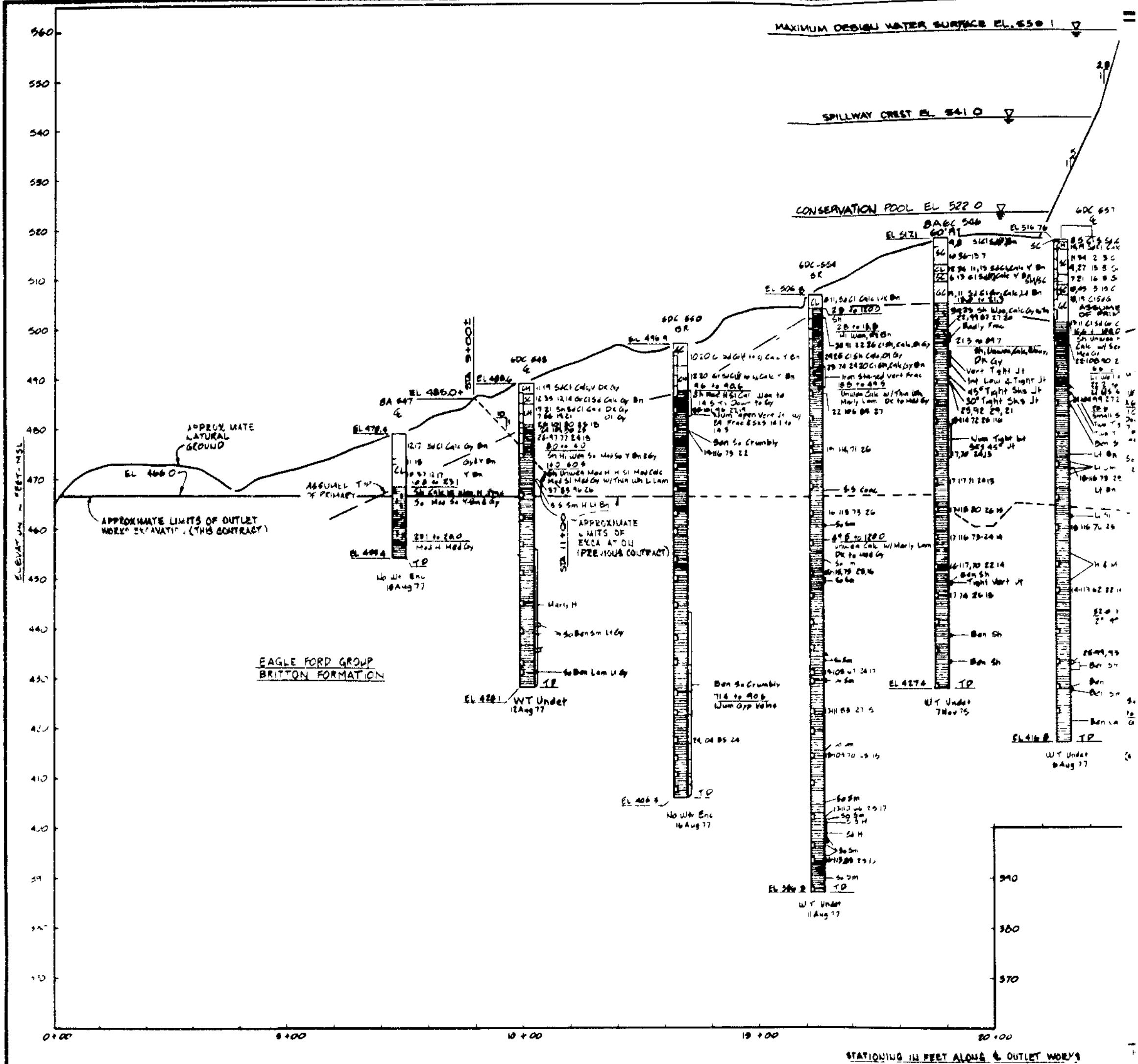
DATED JULY 1981

SHEET NO 14 of 43

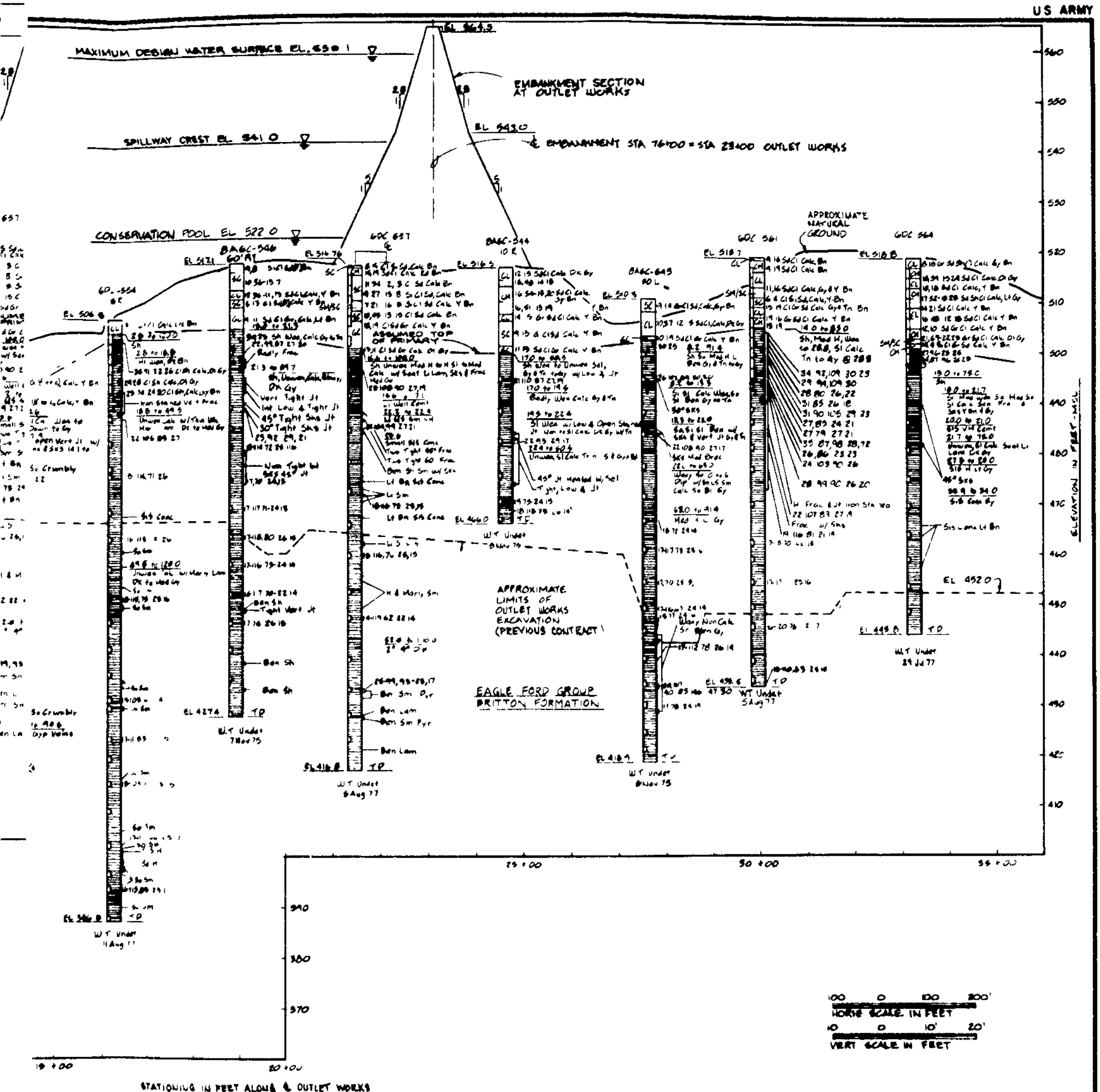
99

PLATE 44

CORPS OF ENGINEERS



NOTES
1 SEE SEQ
2 SEE SEQ
3 SEE SEQ



NOTES:
1. SEE SEQ FOR LEGEND AND GENERAL NOTES
2. SEE SEQ FOR BORING LOCATIONS
3. SEE SEQ FOR EXCAVATION LIMITS

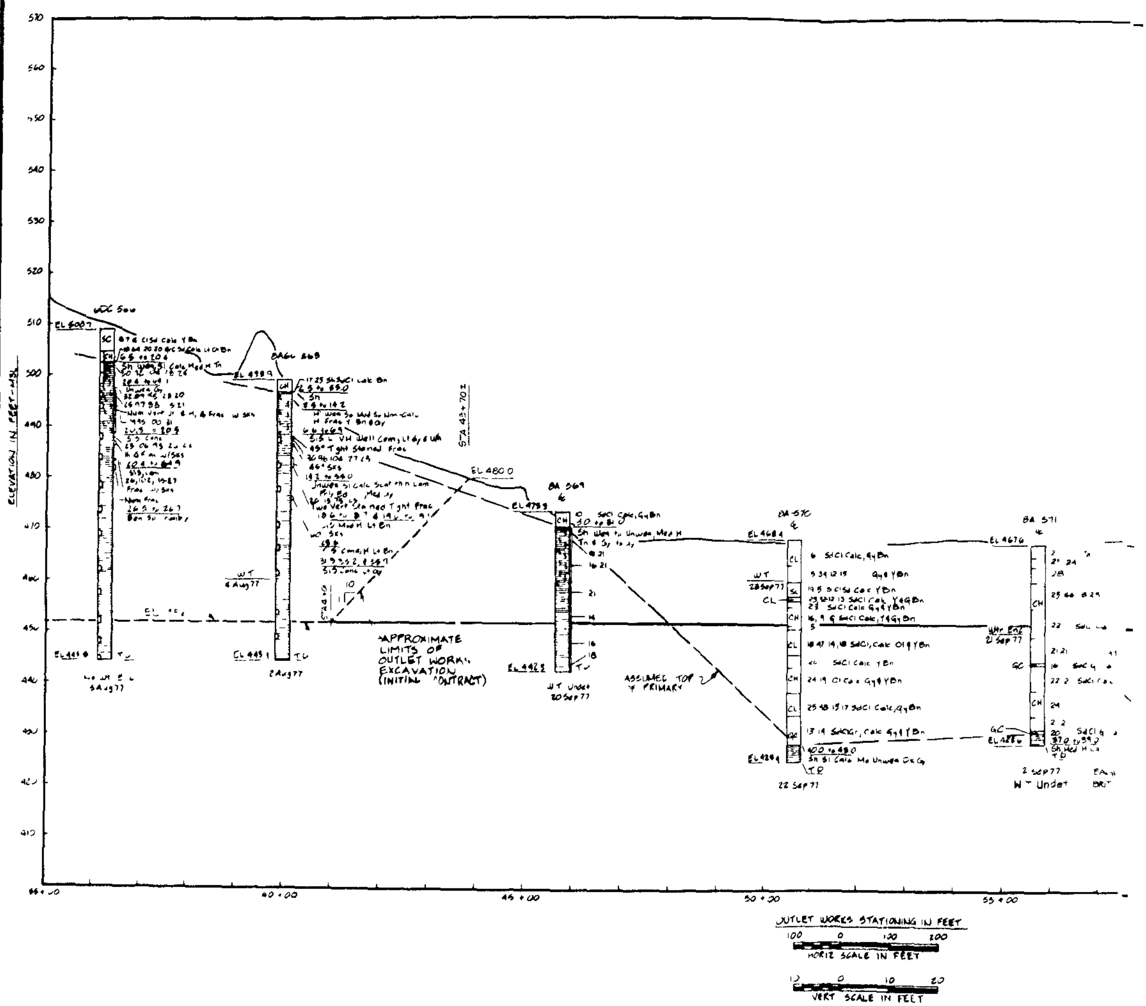
U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

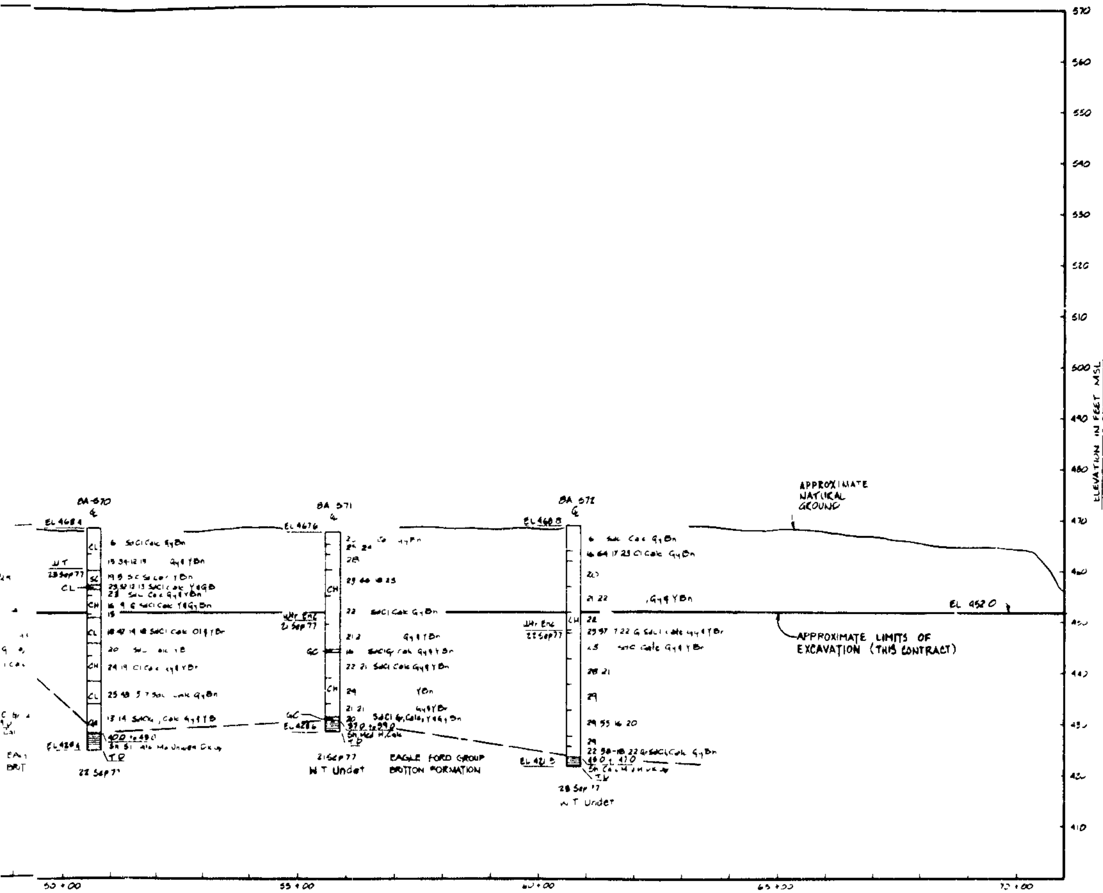
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT, SPILLWAY, AND OUTLET WORKS
OUTLET WORKS
CENTERLINE PROFILE I
STATION 0+00 TO 36+00

DESIGNED BY T. SCHMIDT, K. NICHOLS
DRAWN BY R. REED, M. SCURLLE
REVIEWED BY T. SCHMIDT
SUBMITTED BY

INV NO DACW63 81 B-0043
DATED JULY 1981
DRAWING NUMBER
SHEET NO 16 of 43
SEQUENCE NO 101

PLATE 45


ELEVATION IN FEET-MSL
APPROXIMATE LIMITS OF OUTLET WORKS EXCAVATION (INITIAL CONTRACT)
ASSUMED TOP OF PRIMARY
STA 43+70±
EL 480.0
BA 569
BA 570
BA 571
OUTLET WORKS STATIONING IN FEET
HORIZ SCALE IN FEET
VERT SCALE IN FEET
40+00
45+00
50+00
55+00



OUTLET WORKS STATIONING IN FEET

100 0 100 200
HORIZ SCALE IN FEET

10 0 10 20
VERT SCALE IN FEET

NOTES
1 SEE SEQ __ FOR LEGEND AND GENERAL NOTES
2 SEE SEQ __ FOR LOCATION OF BORINGS
3 SEE SEQ __ FOR EXCAVATION LIMITS

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T SCHMIDT, M NICHOLS
DRAWN BY R REED, M SCOVILLE
REVIEWED BY T. SCHMIDT

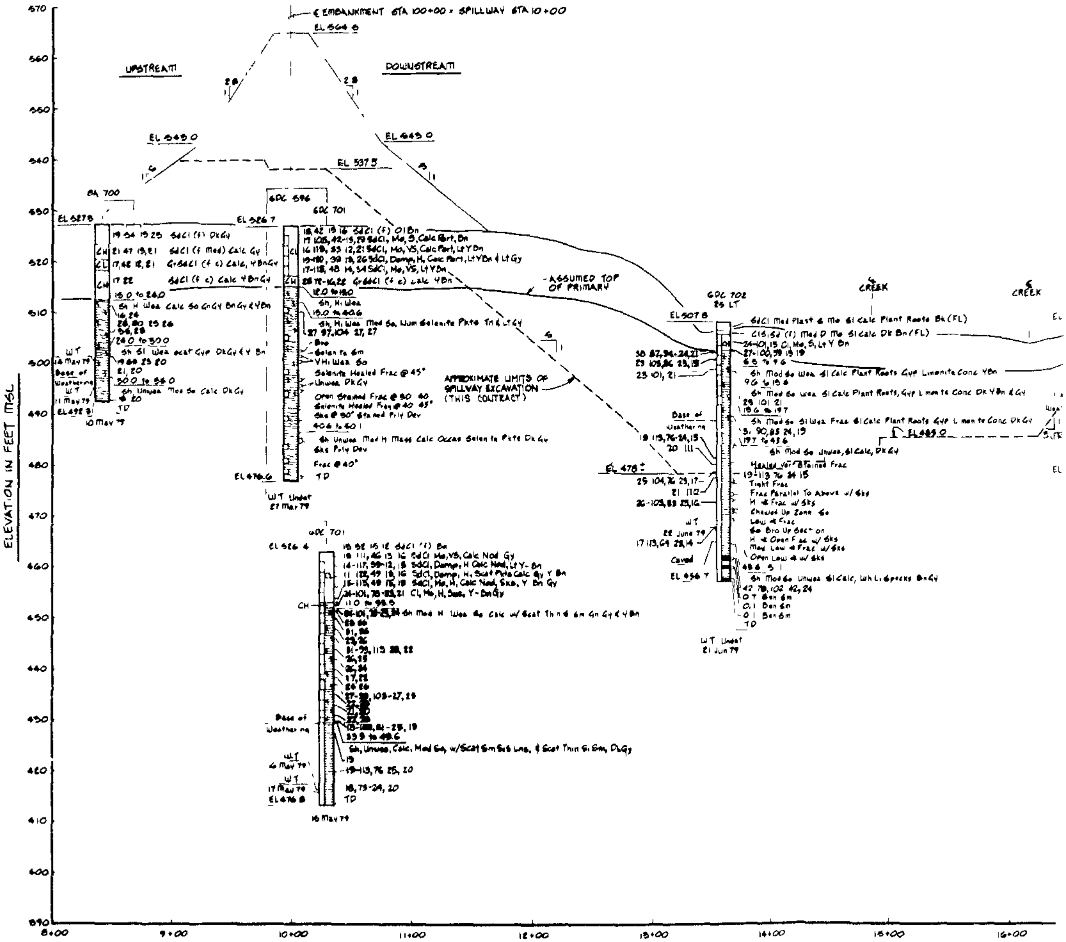
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

OUTLET WORKS CENTERLINE PROFILE II
STATION 35+00 TO STATION 71+00

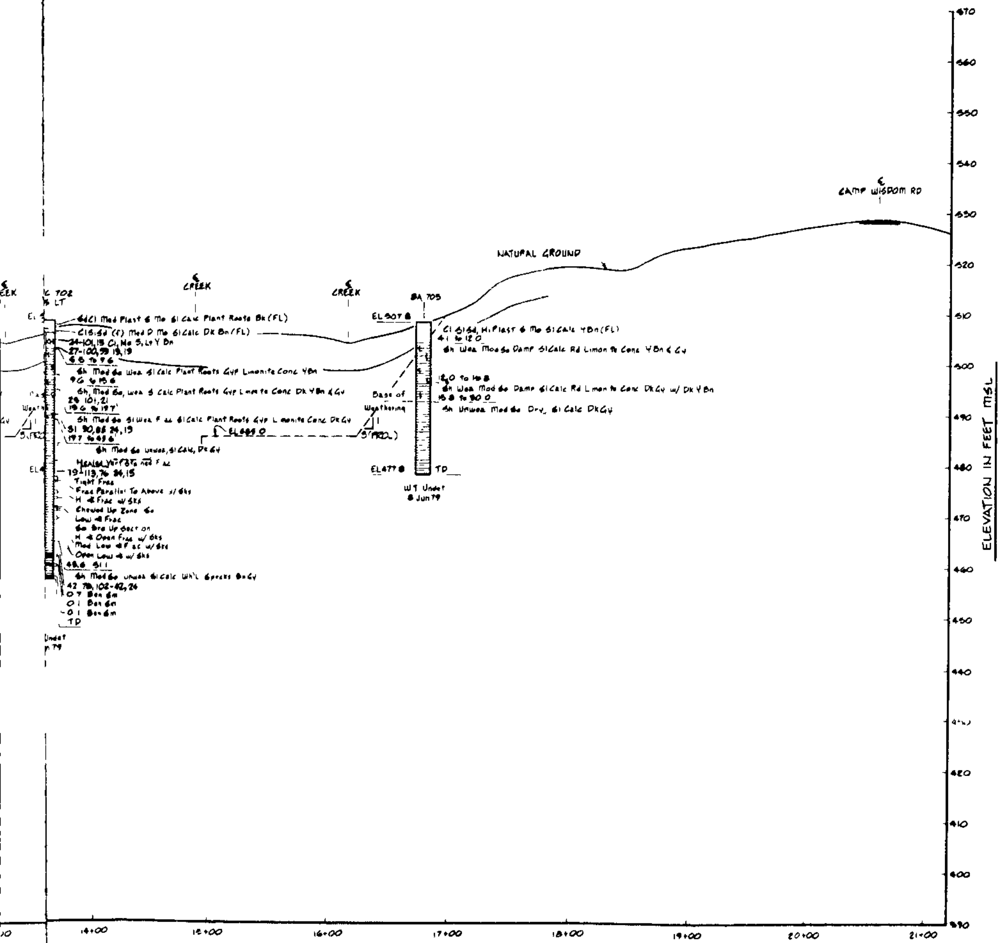
INV NO DACW63-81-B-0045
DATED JULY 1981
SHEET NO 17 of 43
SEQUENCE NO 102

PLATE 46



SPILLWAY CENTERLINE PROFILE

DISTANCE IN FEET

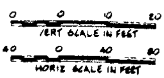


AY CENTERLINE PROFILE

DISTANCE IN FEET

NOTE

1. SEE SEQ FOR LEGEND AND GENERAL NOTES
2. SEE SEQ FOR LOCATION OF BORINGS



U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T. SCHMIDT M. NICHOLS

DRAWN BY R.L. HILL

REVIEWED BY T. SCHMIDT

SUBMITTED BY

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

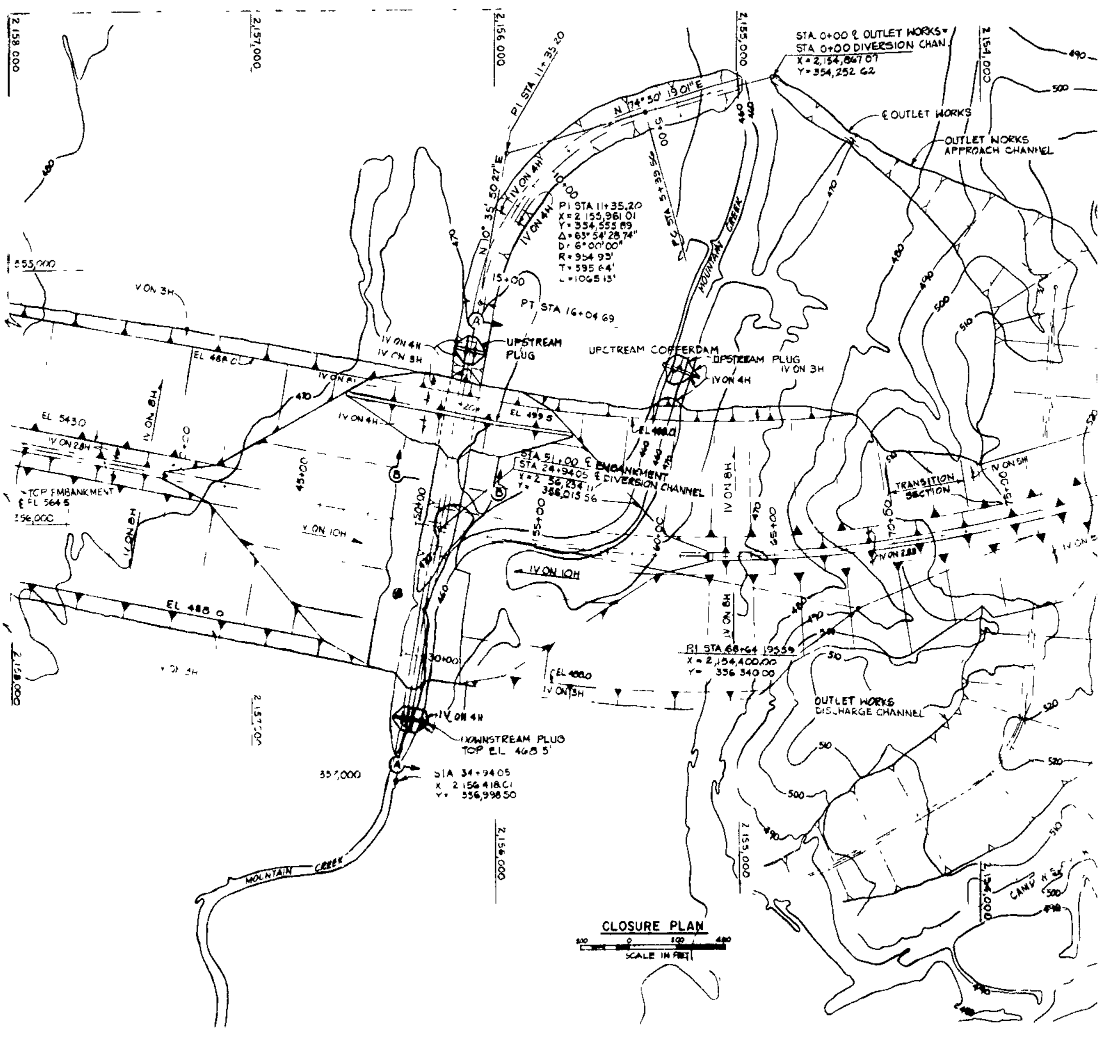
SPILLWAY CENTERLINE PROFILE

DATED JULY 1981

SHEET NO 10 OF 43

103

PLATE 47

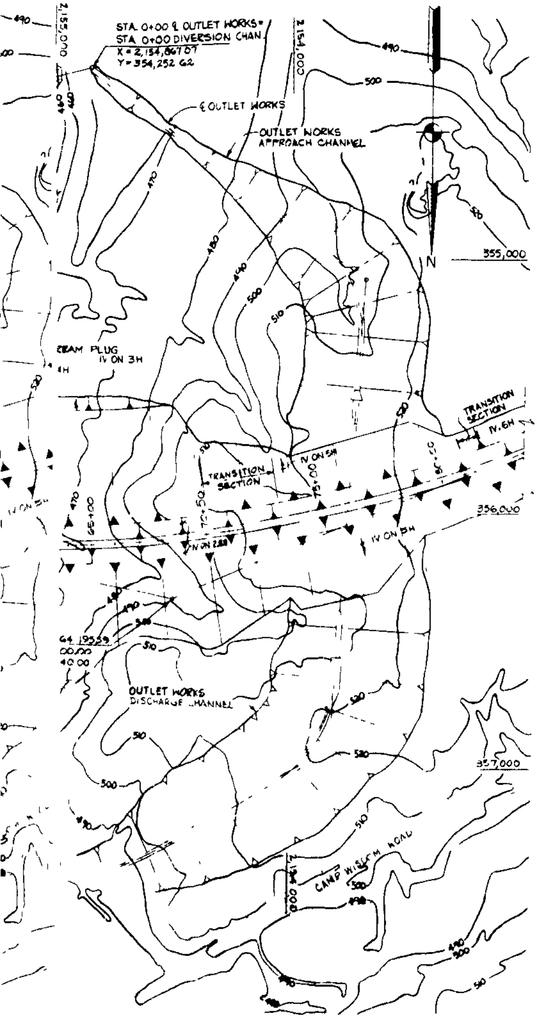


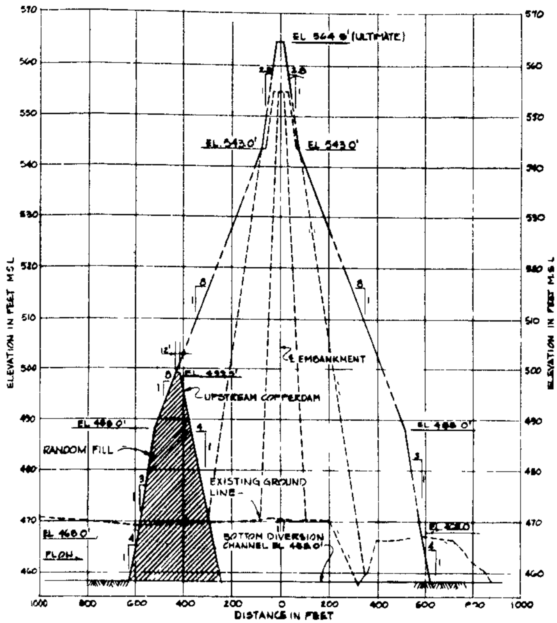
NOTES:

1 SEE SEQ. __ FOR CONSTRUCTIO

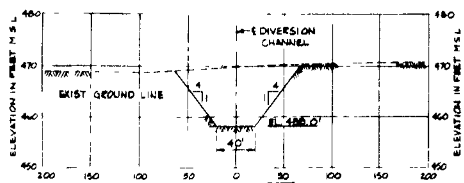
2 TYPICAL EMBANKMENT SECTIO SHOWN ON SEQ ___.

3 THE UPSTREAM PLUGS AND THE C PLUG SHALL BE CONSTRUCTE CLAY MATERIAL.





SECTION A-A



SECTION B-B

NOTES:

1 SEE SEQ___ FOR CONSTRUCTION STAGING
2 TYPICAL EMBANKMENT SECTIONS ARE SHOWN ON SEQ___.
3 THE UPSTREAM PLUGS AND THE DOWNSTREAM PLUG SHALL BE CONSTRUCTED USING CH CLAY MATERIAL

U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY S ARMSTRONG
DRAWN BY J. HELMS
REVIEWED BY S ARMSTRONG

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT

EMBANKMENT CLOSURE

INV NO DACW63 B 0043
DATED JULY 1981
SHEET NO C 18 of 29
31

PLATE 48

UPSTREAM
N
EL 4585
1V on 3H
1V on 8H
1V on 4H
40'±
1V on 4H
℄ DIVERSION CHANNEL
STA 61+00
℄ EMBANKMENT
VARIES
EL 4551
EL 4441
470
10'±
1V on 4H
65'±
VARIES
1V on 1½H
1V on 8H
1V on 3H
EL 4425

PLAN

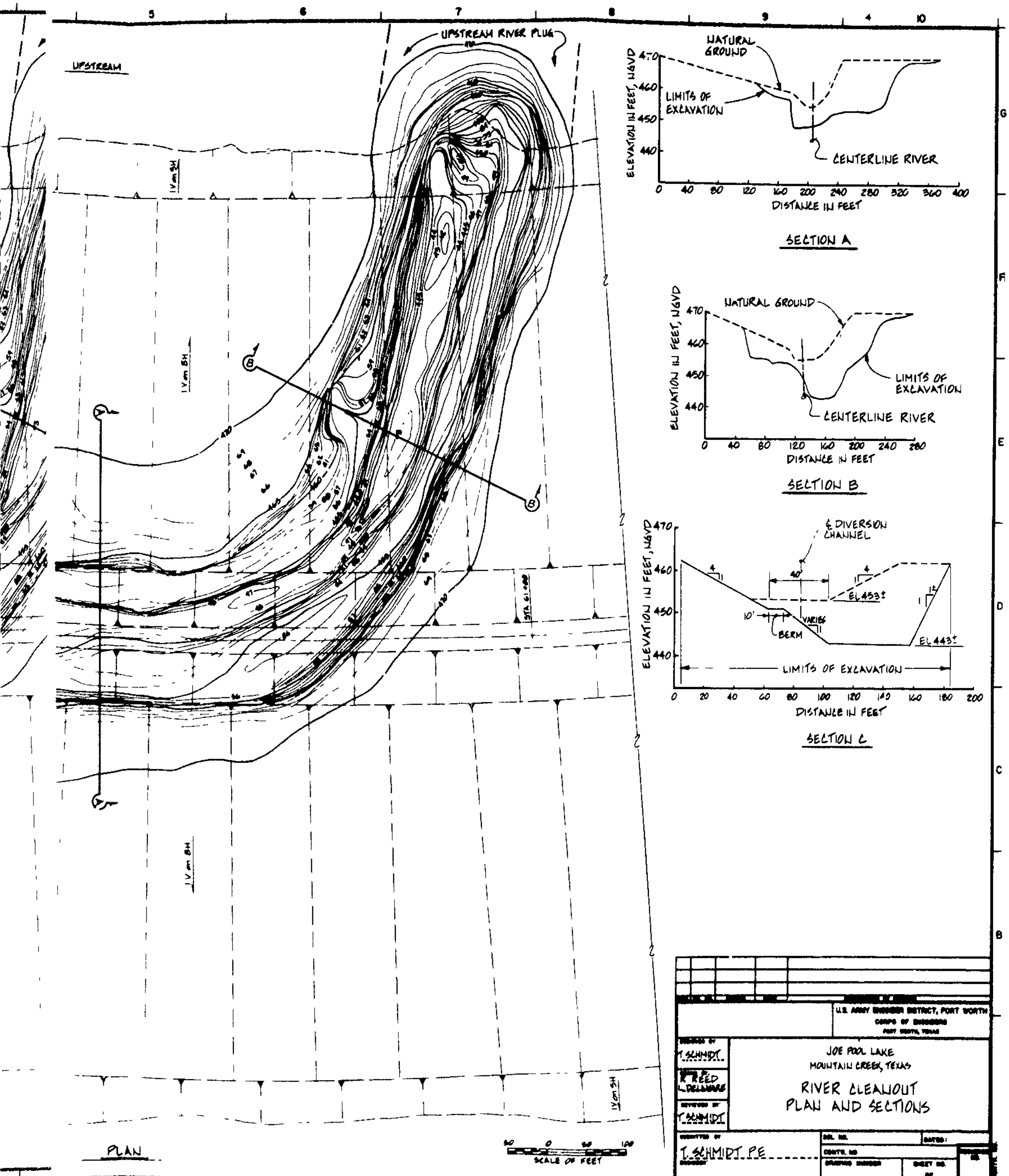
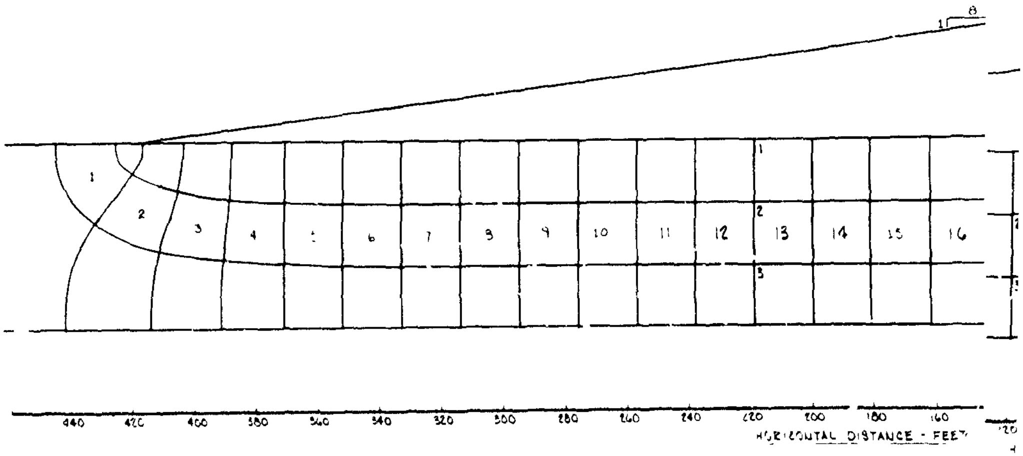

UPSTREAM RIVER PLUG
UPSTREAM
NATURAL GROUND
LIMITS OF EXCAVATION
CENTERLINE RIVER
ELEVATION IN FEET, NGVD
DISTANCE IN FEET
SECTION A
NATURAL GROUND
LIMITS OF EXCAVATION
CENTERLINE RIVER
ELEVATION IN FEET, NGVD
DISTANCE IN FEET
SECTION B
℄ DIVERSION CHANNEL
40'
EL 453±
10'
VARIES
BERM
EL 443±
LIMITS OF EXCAVATION
ELEVATION IN FEET, NGVD
DISTANCE IN FEET
SECTION C
1V on 3H
1V on 8H
1V on 8H
1V on 3H
PLAN
SCALE OF FEET
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
T. SCHMIDT
R. REED
L. DELAMARE
T. SCHMIDT
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
RIVER CLEANOUT
PLAN AND SECTIONS
T. SCHMIDT, P.E.

PLATE 49



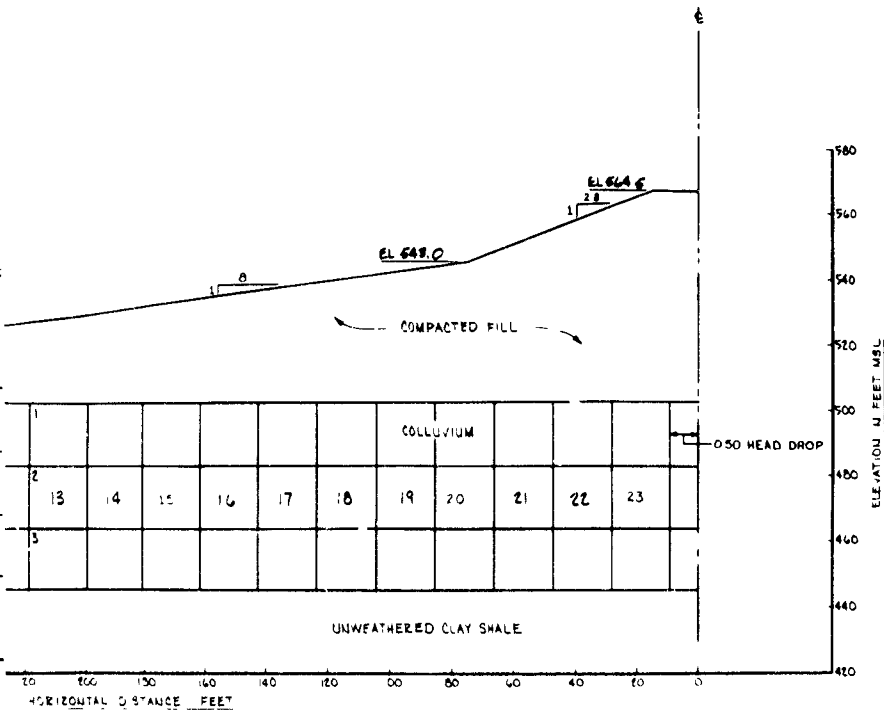
NOTES

1 FLOWNET IS SYMMETRICAL ABOUT THE CENTERLINE

NUMBER OF FLOW CHANNELS - 3
NUMBER OF HEAD DROPS - 47
SEEPAGE QUANTITY - 298 GAL/DAY
EXIT GRADIENT WITH RESERVOIR
EXIT GRADIENT WITH RESERVOIR A

ASSUMPTIONS

1 $K_H = K_V =$ [illegible] $^{-4}$ CM/SEC
2 UNWEATHERED CLAY SHALE AND
3 SEEPAGE OCCURS THROUGH THE
4 COLLUVIUM IS CONTINUOUS UNDE
TO THE GROUND SURFACE



NUMBER OF FLOW CHANNELS - 3
NUMBER OF HEAD DROPS - 47
SEEPAGE QUANTITY - 298 GAL/DAY PER FOOT OF DAM (AT CONSERVATION POOL)
EXIT GRADIENT WITH RESERVOIR AT CONSERVATION POOL = 0.06
EXIT GRADIENT WITH RESERVOIR AT MAXIMUM DESIGN WATER SURFACE = 0.15

ASSUMPTIONS

1. $K_H = K_V = 0.^{4} CM/SEC$
2. UNWEATHERED CLAY SHALE AND COMPACTED FILL ARE IMPERMEABLE
3. SEEPAGE OCCURS THROUGH THE COLLUVIUM ONLY
4. COLLUVIUM IS CONTINUOUS UNDERNEATH THE DAM AND EXTENDS TO THE GROUND SURFACE

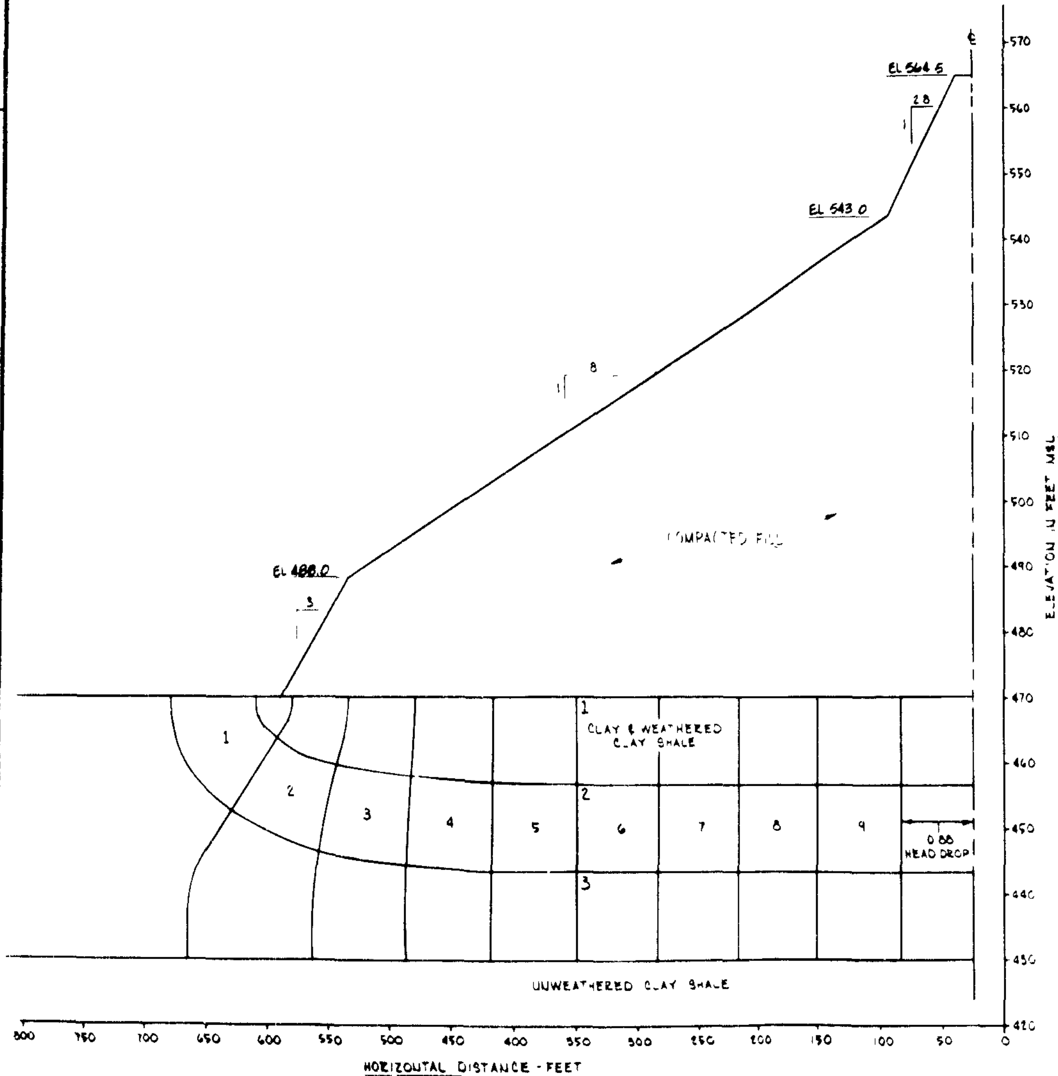
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY MES
DRAWN BY MES
CHECKED BY MES/TUS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

FLOWNET FOR ASSUMED BURIED CHANNEL AT RIGHT ABUTMENT

INV NO
DATED
DRAWING NUMBER
SHEET NO



FLOODPLAIN - APPROXIMATE STATION 40+00

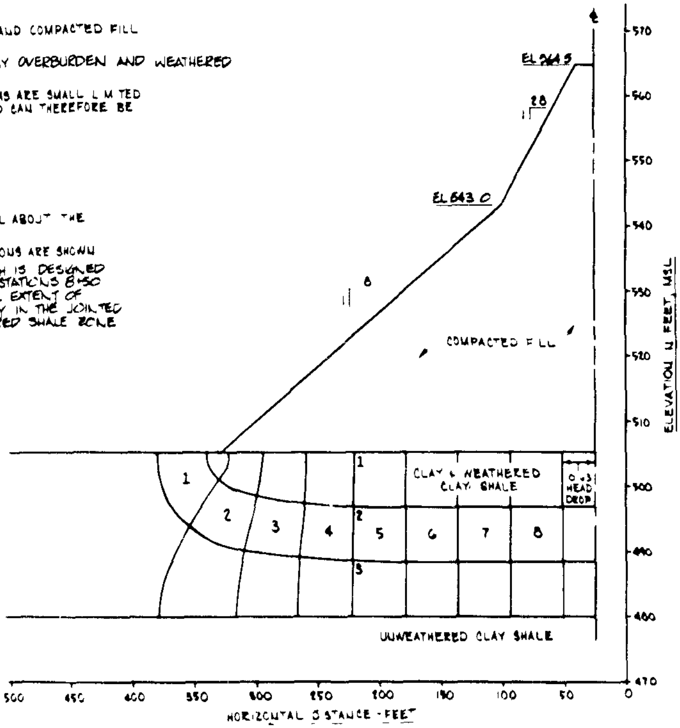
NUMBER OF FLOW CHANNELS = 3
NUMBER OF HEAD DROPS = 19.8
SEEPAGE QUANTITY = 1.67 × 10 [illegible] GAL/DAY PER FOOT OF DAM AT CONSERVATION POOL)
EXIT GRADIENT WITH RESERVOIR AT CONSERVATION POOL = [illegible]
EXIT GRADIENT WITH RESERVOIR AT MAXIMUM DESIGN WATER SURFACE = 0.27

ASSUMPTIONS

1 $K_H = 25K_V = 10^{-8}$ CM/SEC
2 UNWEATHERED CLAY SHALE AND COMPACTED FILL ARE IMPERMEABLE
3 SEEPAGE OCCURS IN THE CLAY OVERBURDEN AND WEATHERED CLAY SHALE ONLY
4 ANY SAND AND GRAVEL SEAMS ARE SMALL, LIMITED IN EXTENT, VERY CLAYEY AND CAN THEREFORE BE IGNORED

NOTES

1 FLOWNETS ARE SYMMETRICAL ABOUT THE CENTERLINE
2 TRANSFORMED CROSS SECTIONS ARE SHOWN
3 A DEEP INSPECTION TRENCH IS DESIGNED BETWEEN APPROXIMATE STATIONS 8+50 AND 17+00 TO DETERMINE EXTENT OF SECONDARY PERMEABILITY IN THE JOINTED AND FRACTURED WEATHERED SHALE ZONE



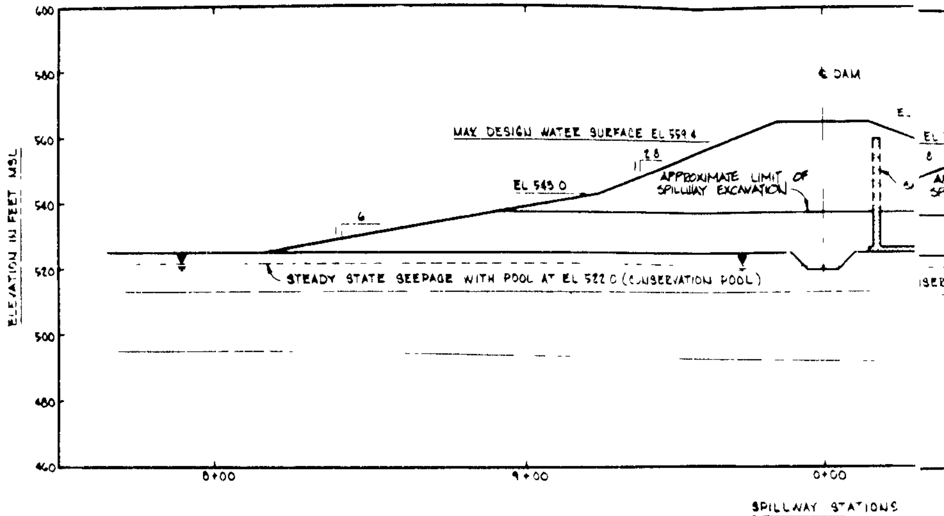
RIGHT ABUTMENT - APPROXIMATE STATION 12+60

NUMBER OF FLOW CHANNELS - 3
NUMBER OF HEAD DROPS = 7.3
SEEPAGE QUANTITY = 6.27 x 10 $^{-4}$ GAL/DAY PER FOOT OF DAM (AT CONSERVATION POOL)
EXIT GRADIENT WITH RESERVOIR AT CONSERVATION POOL = 0.1
EXIT GRADIENT WITH RESERVOIR AT MAXIMUM DESIGN WATER SURFACE = 0.34

U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY	
MES	JOE POOL LAKE MOUNTAIN CREEK, TEXAS
DRAWN BY	
MES	FOUNDATION FLOWNETS AT THE RIGHT ABUTMENT AND FLOODPLAIN
CHECKED BY	
MES/TWS	

INV NO
DATED
DRAWING NUMBER
SHEET NO
SEQUENCE NO.

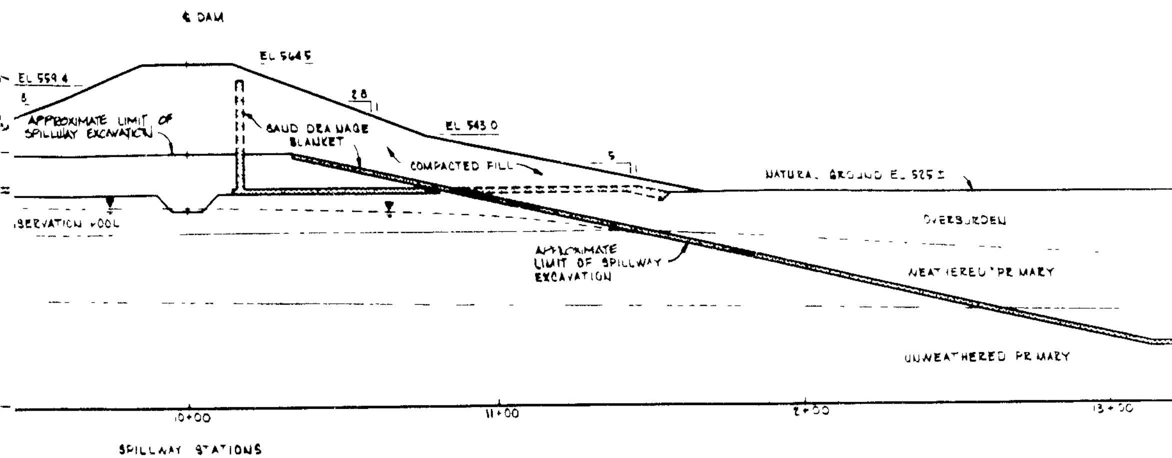


ASSUMED DESIGN PARAMETERS

MATERIAL	K_H (CM/SEC)	K_V (CM/SEC)
COMPACTED FILL	5 x 10 8	1 x 10 8
OVERBURDEN	5 x 10 9	x 10 9
WEATHERED PRIMARY	x 10 8	x 10 9
UNWEATHERED PRIMARY	1 x 10 9	x 10 5

K_H = HORIZONTAL PERMEABILITY

K_V = VERTICAL PERMEABILITY



NOTES

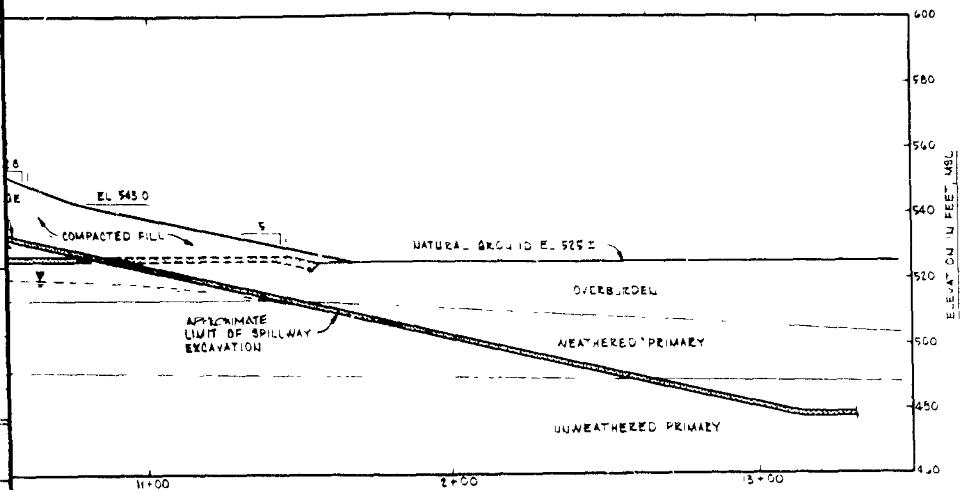
1. LOCATION OF SEEPAGE LINE WAS ESTIMATED USING FINITE ELEMENT COMPUTER ANALYSIS CONDUCTED AT WES
2. NATURAL GROUND ELEVATION AT THE LEFT EMBANKMENT NO 2 APPROXIMATELY EL 525 ... ABOVE CONSERVATION POOL EL 522.0

U S ARMY

MES/TJS

MBP

MES/TJS



NOTES

1. LOCATION OF SEEPAGE LINE WAS ESTIMATED USING FINITE ELEMENT COMPUTER ANALYSIS CONDUCTED AT WES
2. NATURAL GROUND ELEVATION AT THE LEFT EMBANKMENT NO 2 APPROXIMATELY EL 525 IS ABOVE CONSERVATION POOL EL 522.0

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

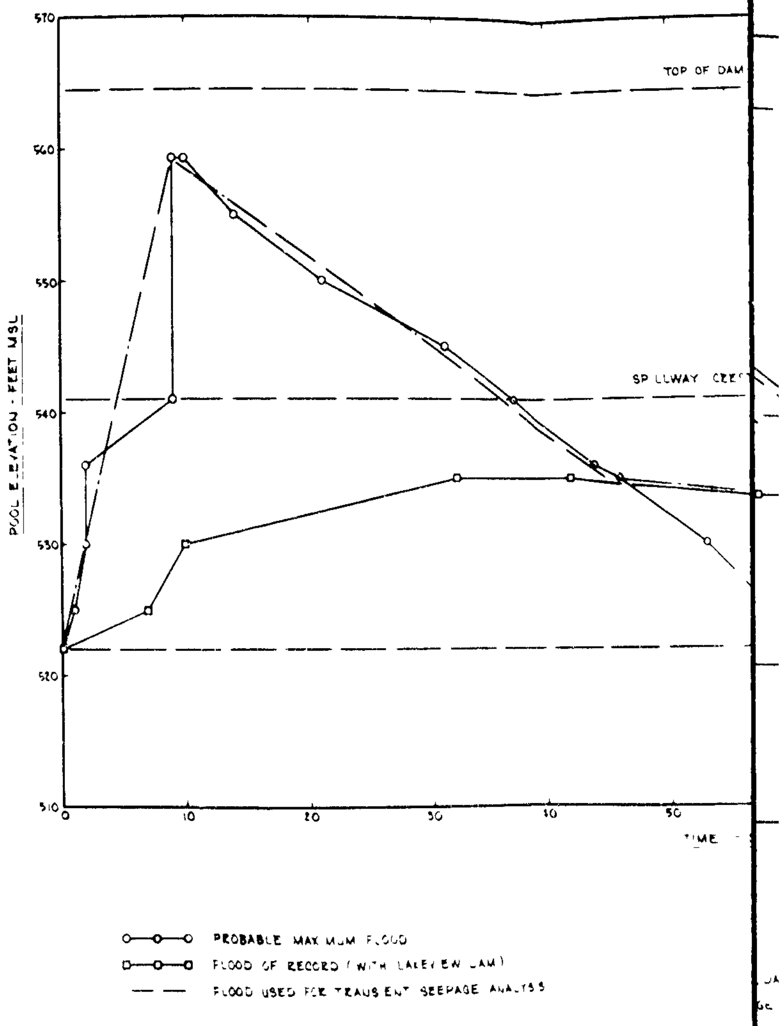
DESIGNED BY MES/TWS
DRAWN BY MBP
CHECKED BY MES/TWS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

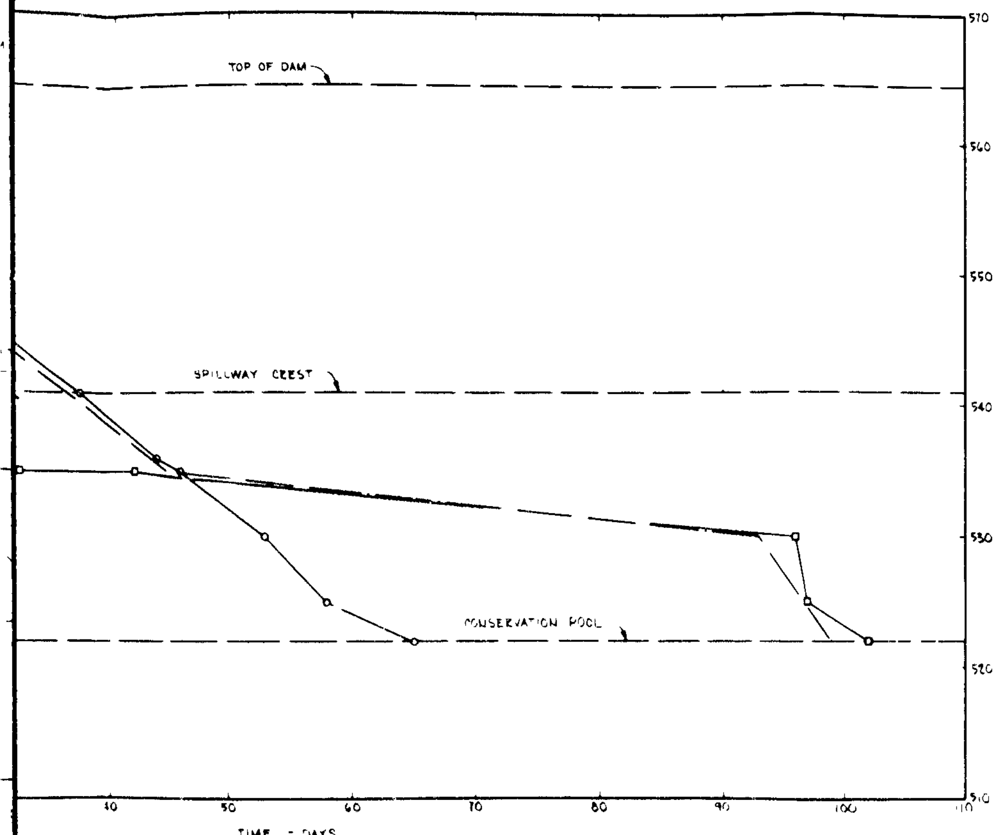
LEFT EMBANKMENT NO 2 (SPILLWAY)
STEADY STATE SEEPAGE AT
CONSERVATION POOL (EL 522.0)

INVITATION NO
SPECIFICATIONS DATED
DRAWING NUMBER
SHEET NO
OF
SEQUENCE NO

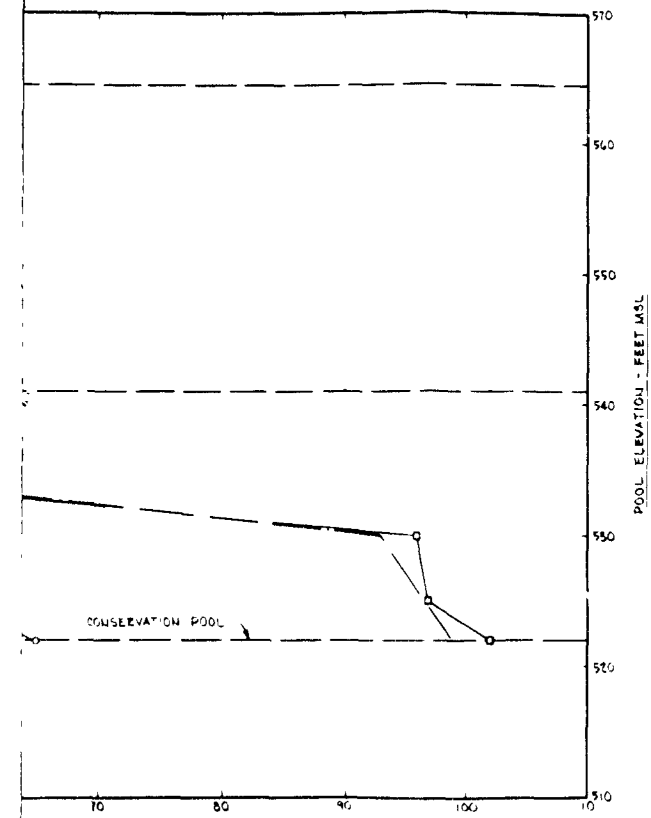
PLATE 59



570
560
550
540
530
520
510
TOP OF DAM
SP LLWAY CEES
POOL ELEVATION - FEET MSL
0
10
20
30
40
50
TIME
PROBABLE MAX MUM FLOOD
FLOOD OF RECORD (WITH LAKEVIEW DAM)
FLOOD USED FOR TRANSIENT SEEPAGE ANALYSIS



DAM)
GE ANALYSIS



U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

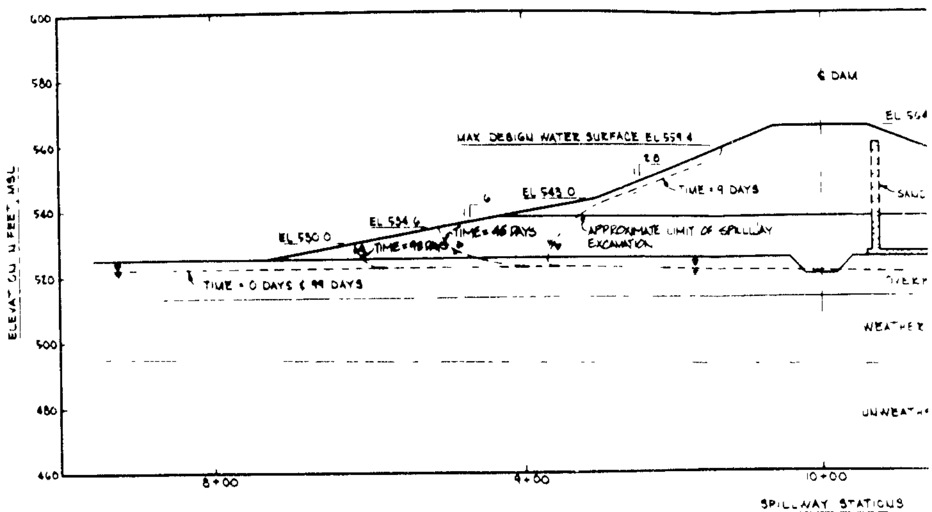
TWS

TBP

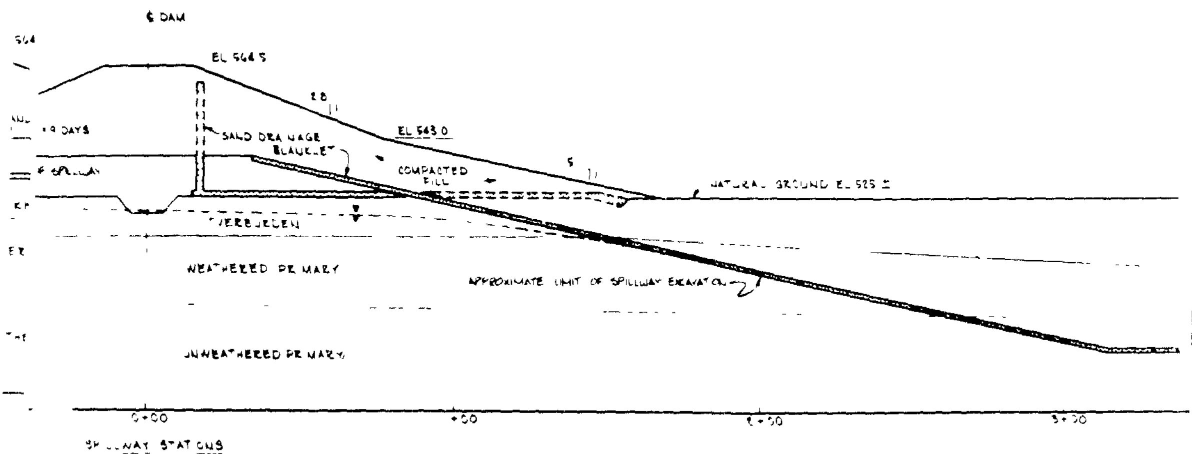
ME TWS

JOE [illegible] LAKE

[illegible] ELEVATION [illegible]



℄ DAM
EL 56
MAX DESIGN WATER SURFACE EL 559.4
2.8
TIME = 9 DAYS
SAL
EL 543.0
6
EL 534.6
TIME = 46 DAYS
APPROXIMATE LIMIT OF SPILLWAY EXCAVATION
EL 530.0
TIME = 0 DAYS & 99 DAYS
WEATHER
UNWEATH
ELEVATION IN FEET, MSL
SPILLWAY STATIONS
8+00
9+00
10+00
600
580
560
540
520
500
480
460



NOTES

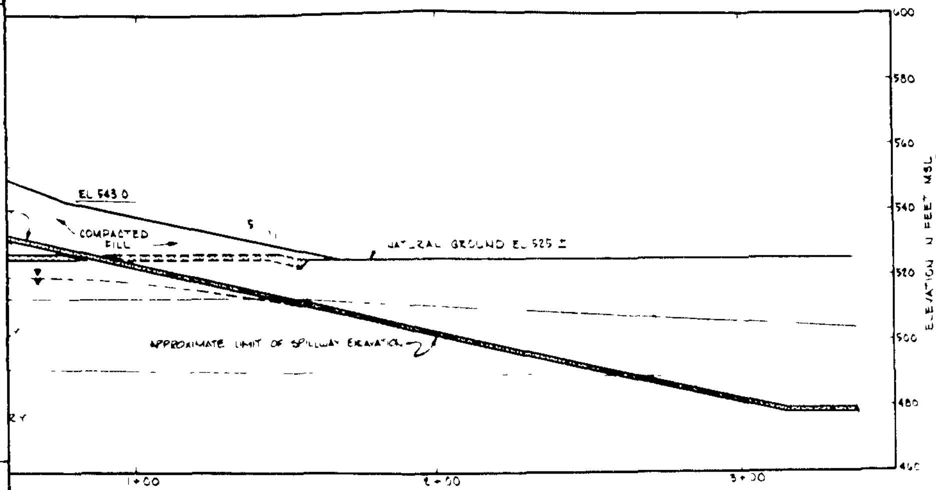
1. SEEPAGE LINES SHOWN WERE DETERMINED USING FINITE ELEMENT COMPUTER ANALYSES CONDUCTED AT WES
2. WATER SURFACE ELEVATIONS AND DURATIONS ARE SHOWN ON PLATE __
3. SEE PLATE __ FOR A TABULATION OF ASSUMED PERMEABILITIES
4. THE STEADY STATE SEEPAGE CONDITION AT CONSERVATION POOL (PLATE __) WAS ASSUMED AS INITIAL CONDITIONS FOR THESE ANALYSES

U.S. ARMY EN

MES/TLS

MBP

MES/TLS



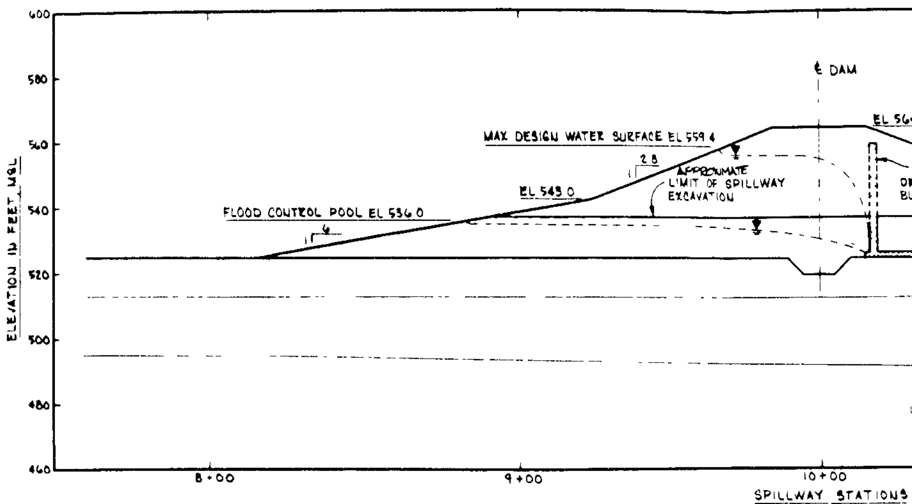
NOTES

1. SEEPAGE LINES SHOWN WERE DETERMINED USING FINITE ELEMENT COMPUTER ANALYSES CONDUCTED AT WES
2. WATER SURFACE ELEVATIONS AND DURATIONS ARE SHOWN ON PLATE
3. SEE PLATE __ FOR A TABULATION OF ASSUMED PERMEABILITIES
4. THE STEADY STATE SEEPAGE CONDITION AT CONSERVATION POOL (PLATE __) WAS ASSUMED AS INITIAL CONDITIONS FOR THESE ANALYSES

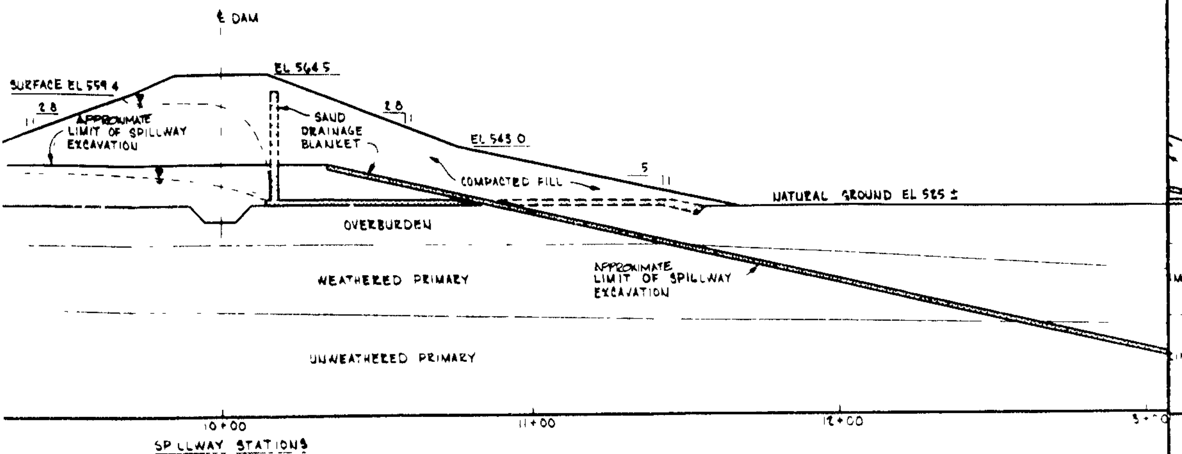
U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY MES/TLS	JOE POOL LAKE MOUNTAIN CREEK TEXAS
DRAWN BY MBP	LEFT EMBANKMENT NO 2 (SPILLWAY) TRANSIENT SEEPAGE LINES
CHECKED BY MES/TLS	

INVITATION NO
SPECIFICATIONS DATED
DRAWING NUMBER — SHEET NO — OF — SEQUENCE NO



℄ DAM
MAX DESIGN WATER SURFACE EL 559.4
2.8
1
APPROXIMATE LIMIT OF SPILLWAY EXCAVATION
EL 543.0
FLOOD CONTROL POOL EL 536.0
6
1
600
580
560
540
520
500
480
460
ELEVATION IN FEET MSL
8+00
9+00
10+00
SPILLWAY STATIONS

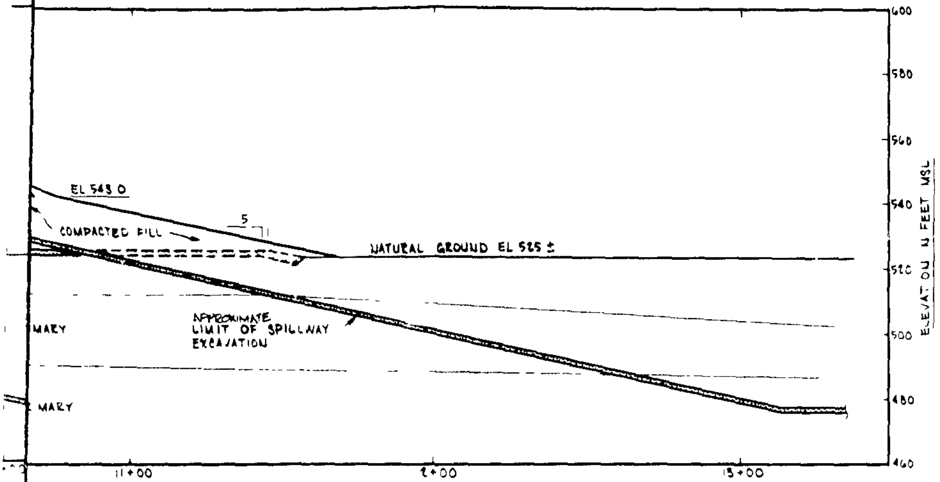


NOTES

1 LOCATION OF SEEPAGE LINES DETERMINED USING FINITE ELEMENT ANALYSES CONDUCTED AT WES

2 SEE PLATE _ FOR A TABULATION OF ASSUMED PERMEABILITIES

3 DEVELOPMENT OF THE SEEPAGE LINES SHOWN IS HIGHLY UNLIKELY DUE TO THE SHORT DURATION OF THE POOLS, THE IMPERVIOUS NATURE OF THE EMBANKMENT MATERIALS AND THE RELATIVELY LONG SEEPAGE PATHS, i.e. THE CONDITIONS SHOWN ON PLATES AND _ ARE MORE APPROPRIATE FOR DESIGN



NOTES

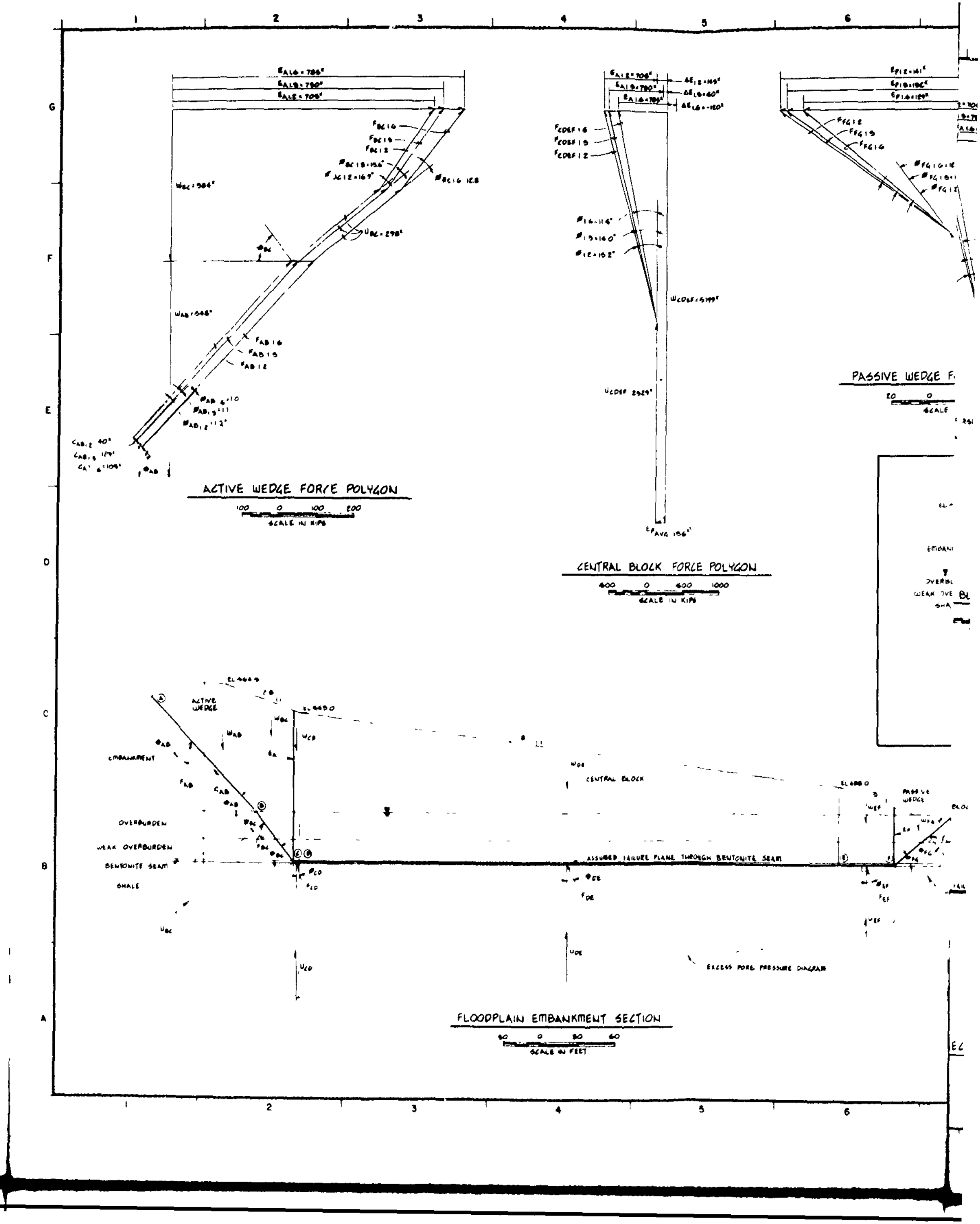
1 LOCATION OF SEEPAGE LINES DETERMINED USING FINITE ELEMENT ANALYSES CONDUCTED AT WES

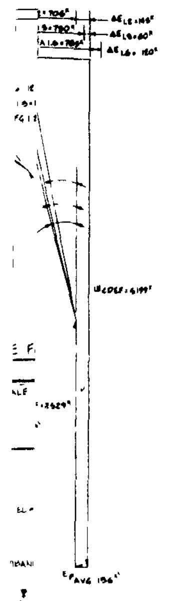
2 SEE PLATE __ FOR A TABULATION OF ASSUMED PERMEABILITIES

3 DEVELOPMENT OF THE SEEPAGE LINES SHOWN IS HIGHLY UNLIKELY DUE TO THE SHORT DURATION OF THE POOLS, THE IMPERVIOUS NATURE OF THE EMBANKMENT MATERIALS AND THE RELATIVELY LONG SEEPAGE PATHS I.E. THE CONDITIONS SHOWN ON PLATES AND _ ARE MORE APPROPRIATE FOR DESIGN

U S ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH TEXAS	
DESIGNED BY MES/	JOE POOL LAKE MOUNTAIN CREEK TEXAS
DRAWN BY MBP	LEFT EMBANKMENT NO 2 (SPILLWAY) STEADY STATE SEEPAGE AT FLOOD CONTROL POOL (EL 536 0) AND AT MAXIMUM DESIGN WATER SURFACE (EL 559 4)
CHECKED BY MES/THS	
	INVITATION NO SPECIFICATIONS DATED DRAWING NUMBER SHEET NO OF

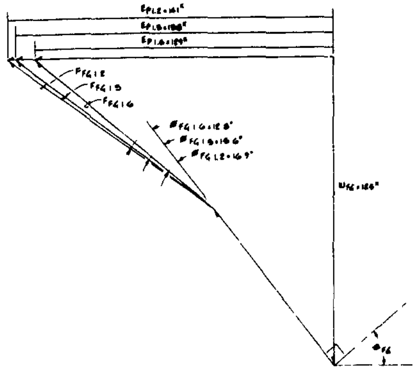
PLATE 55


ACTIVE WEDGE FORCE POLYGON
100 0 100 200
SCALE IN KIPS
CENTRAL BLOCK FORCE POLYGON
400 0 400 1000
SCALE IN KIPS
PASSIVE WEDGE F
FLOODPLAIN EMBANKMENT SECTION
60 0 30 60
SCALE IN FEET
ACTIVE WEDGE
EMBANKMENT
OVERBURDEN
WEAK OVERBURDEN
BENTONITE SEAM
SHALE
CENTRAL BLOCK
PASSIVE WEDGE
ASSUMED FAILURE PLANE THROUGH BENTONITE SEAM
EXCESS PORE PRESSURE DIAGRAM



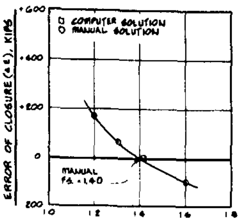
BLOCK FORCE POLYGON

0 600 1000
SCALE IN KIPS

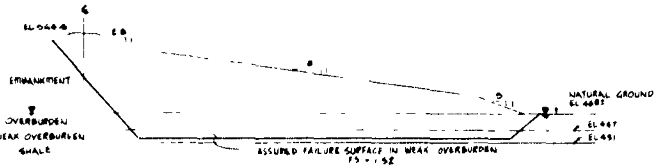


PASSIVE WEDGE FORCE POLYGON

20 0 20 40
SCALE IN KIPS



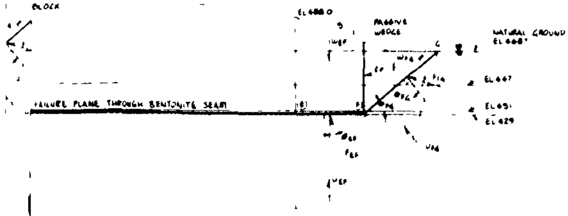
THE MINIMUM FACTOR OF SAFETY CALCULATED USING COMPUTER METHODS IS 1.41, MANUAL CALCULATIONS FOR VERIFYING COMPUTER ACCURACY ARE PRESENTED ON THIS PLATE.



FLOODPLAIN EMBANKMENT SECTION

50% EXCESS PORE PRESSURE IN FOUNDATION

60 0 60 120
SCALE IN FEET



ECTION

NOTES

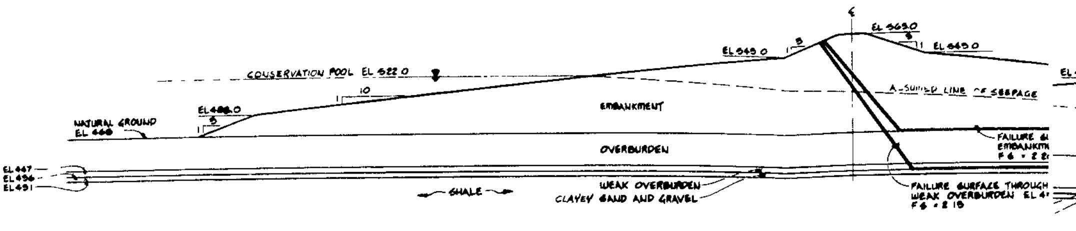
1. SEE PLATE FOR ADOPTED SHEAR STRENGTHS AND UNIT WEIGHTS
2. FOR SIMPLICITY THE ANALYSES SHOWN ON THIS PLATE IGNORED THE SAND AND GRAVEL STRATUM NORMALLY ASSUMED PRESENT AT THE TOP OF PRIMARY SHALE IN THE FLOODPLAIN
3. THE ANALYSES WERE CONDUCTED ASSUMING 50% EXCESS PORE PRESSURE IN THE FOUNDATION, S STRENGTH IN THE FOUNDATION AND Q STRENGTH IN THE EMBANKMENT

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

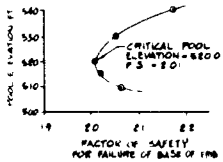
DESIGNED BY
DRAWN BY R. HILL
CHECKED BY

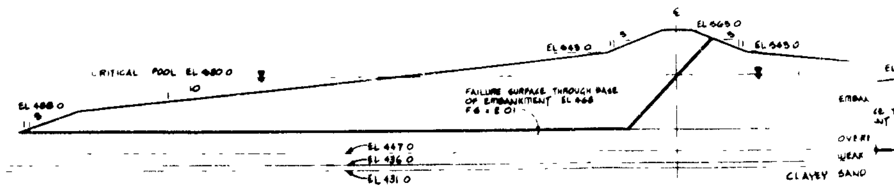
JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT AND SPILLWAY
FLOODPLAIN EMBANKMENT SECTION
STABILITY ANALYSES
WEDGE METHOD
END OF CONSTRUCTION CONDITIONS WITH
50% EXCESS PORE PRESSURE IN FOUNDATION

INV NO | DATED
CONTR NO
DRAWING NUMBER | SHEET NO OF
SEQUENCE NO.



CASE 1 STEADY SEEPAGE





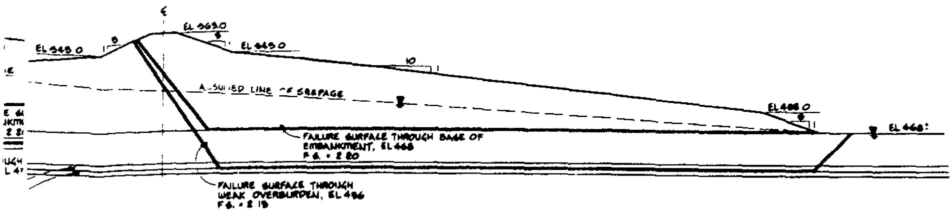
CASE 2 PARTIAL POOL

NOTES

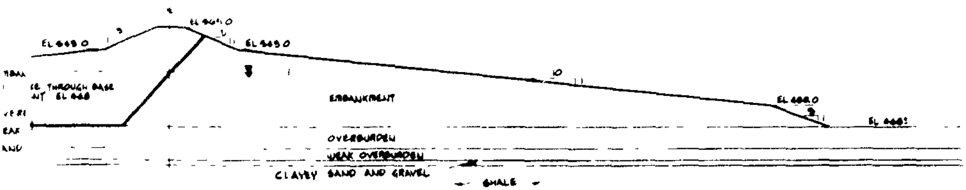
1. THE LINES OF SEEPAGE SHOWN ON THIS PLATE ARE CONSERVATIVELY HIGH SINCE THE RESULTING COMPUTED FACTORS OF SAFETY DO NOT CONTROL THE EMBANKMENT SECTION MORE REALISTIC ASSUMPTIONS ARE NOT WARRANTED
2. THE ELEVATON OF THE EMBANKMENT CREST HAS BEEN CHANGED FROM 565.0 TO 566.5 AND THE SLOPES OF THE UPPER 21.5 FEET OF THE EMBANKMENT HAVE BEEN CHANGED FROM 1 ON 3H TO 1V ON 2.5H SINCE THESE ANALYSES WERE COMPLETED THE 1 VERTICAL ON 10 HORIZONTAL SLOPES HAVE BEEN CHANGED TO 1 VERTICAL ON 8 HORIZONTAL
3. MANUAL CALCULATIONS WERE NOT PERFORMED FOR THESE CONDITIONS

MATERIAL \ PROPERTY	UNIT WEIGHT PCF	SHEAR STRENGTH			
		S		(R+S)/2	
		φ	C, ksf	φ	C, ksf
EMBANKMENT	125	20°	0	16°	0.1
OVERBURDEN	129	20°	0	16.5°	0.5
WEAK OVERBURDEN	124	20°	0	16.4°	0.5
SAND & GRAVEL	52	30°	0	-	-
SHALE	25	18°	1.0	-	-

ADOPTED DESIGN PARAMETERS



CASE 1: STEADY SEEPAGE

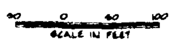


CASE 2 PARTIAL POOL

PLATE ARE CONSERVATIVELY HIGH
...CTORS OF SAFETY DO NOT CONTROL
REALISTIC ASSUMPTIONS ARE

...REST HAS BEEN CHANGED FROM 563.0
UPPER 85 FEET OF THE EMBANKMENT
... TO 1V ON 2.0H SINCE THESE ANALYSES
... HORIZONTAL SLOPES HAVE BEEN CHANGED

PERFORMED FOR THESE CONDITIONS



U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

LAKEVIEW LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT AND SPILLWAY
FLOODPLAIN EMBANKMENT SECTION
STABILITY ANALYSES
STEADY SEEPAGE AND
PARTIAL POOL CONDITIONS

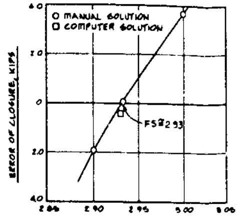
DRAWN BY: R.L. HILL

TO ACCOMPANY DESIGN MEMORANDUM NO. 9
EMBANKMENT AND SPILLWAY

SLICE NO	AREA SQ FT	WEIGHT, KIPS MOIST	WEIGHT, KIPS BUOYANT	WEIGHT, KIPS TOTAL	BASE LENGTH, FEET	COHESION* C_D, KIPS	Φ_D*
1	209	26.0	–	26 0	28	15 9	0 61°
2	660	70 0	–	70 0	25	11 9	0 51
3	504	65 0	–	65 0	16	7 6	0 51
4	646	80 8	–	80 8	10	4 8	0 51
4	16	–	1 1	1 1	10	6 8	0 34
5	646	80 8	–	87 8	21	14 5	0 34
5	155		19 0				
6	436	68 9	–	84 3	20	15 6	0 34
6	228		15 4				
7	480	60 0	–	81 6	21	14 5	0 34
7	520	–	21 6				
8	400	50 0	–	74 5	21	14 5	0 34
8	560		24 5				
9	320	40 0		65 0	21	14 5	0 34
9	540		25 0				
10	240	30 0		50.2	21	14 5	0 34
10	500		20 2				
11	152	19 0	–	31 8	20	15 6	0 34
11	190	–	12 8				
12	92	11 4	–	16 9	22	14 8	0 34
12	80	–	5 4				

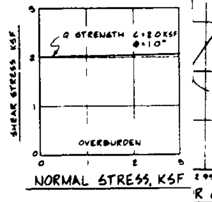
*BASED ON FS = 2.95

SLICE PARAMETERS

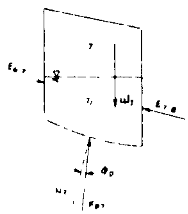


TRIAL FACTOR OF SAFETY

THE MINIMUM FACTOR OF SAFETY CALCULATED BY COMPUTER METHOD IS 2.93. MANUAL CALCULATIONS FOR VERIFYING COMPUTER ACCURACY ARE PRESENTED ON THIS PLATE.

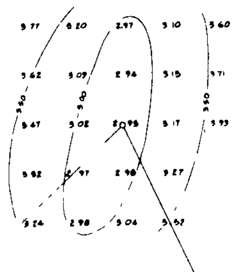


ADOPTED

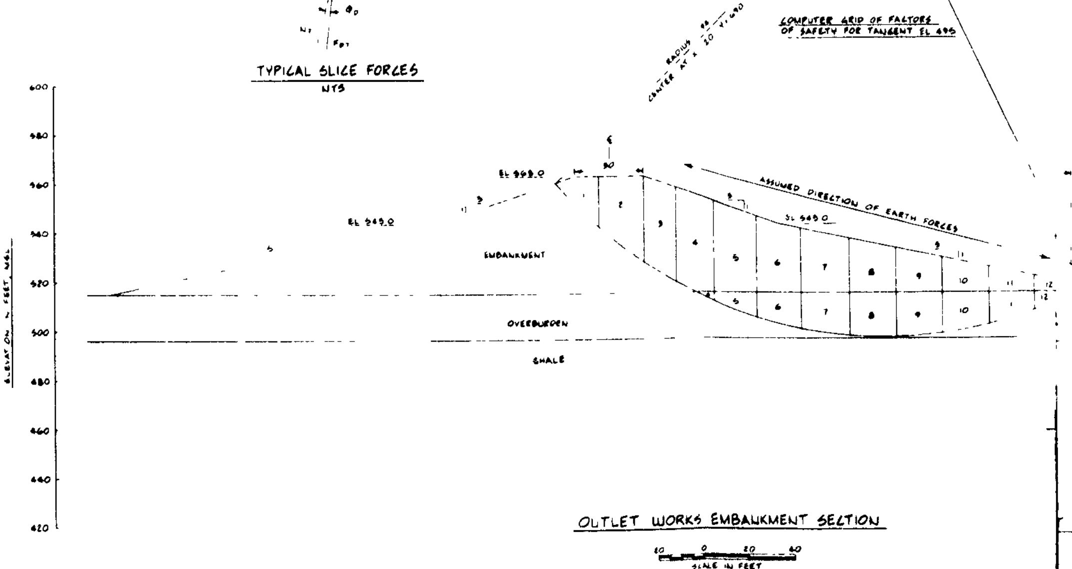


TYPICAL SLICE FORCES

NTS

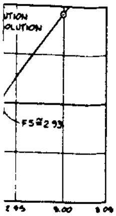


COMPUTER GRID OF FACTORS OF SAFETY FOR TANGENT EL 495



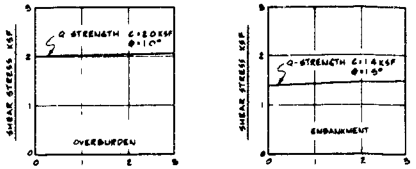
OUTLET WORKS EMBANKMENT SECTION

SCALE IN FEET

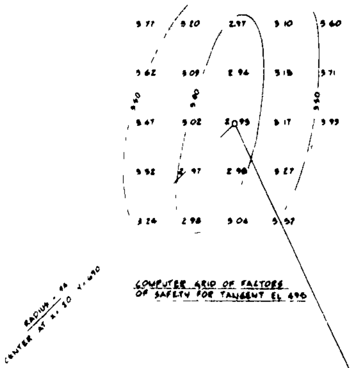


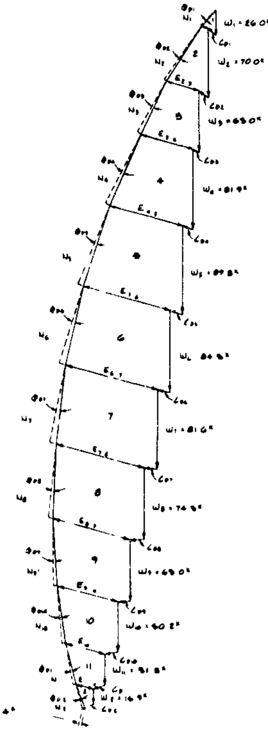
R OF SAFETY

OR OF SAFETY
D OMPUTER METHOD IS
LCULATIONS FOR
ITER ACCURACY ARE
HIS PLATE.

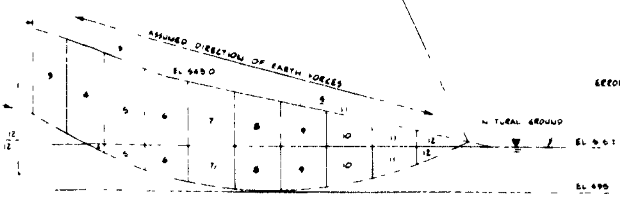


ADOPTED DESIGN PARAMETERS





COMPOSITE FORCE POLYGON FOR FS = 2.95



T WORKS EMBANKMENT SECTION

NOTE

1. THE ELEVATION OF THE EMBANKMENT CREST HAS BEEN CHANGED FROM 565.0 TO 564.5, AND THE SLOPES OF THE UPPER 21.5 FEET OF THE EMBANKMENT HAVE BEEN CHANGED FROM 1 VERTICAL ON 3 HORIZONTAL TO 1 VERTICAL ON 2.8 HORIZONTAL SINCE THESE ANALYSES WERE COMPLETED. THESE CHANGES ARE CONSIDERED TOO SLIGHT TO RE-ANALYZE THE SECTION.

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

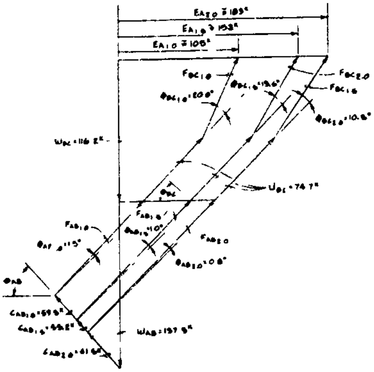
DESIGNED BY
DRAWN BY
CHECKED BY

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT AND SPILLWAY
OUTLET WORKS EMBANKMENT SECTION
STABILITY ANALYSES

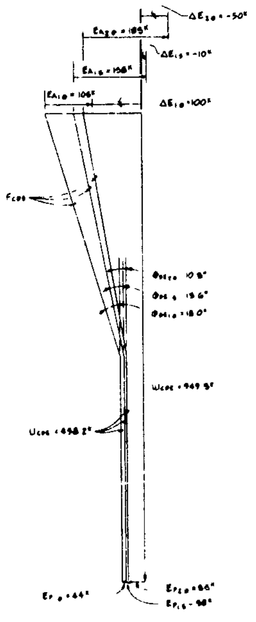
CIRCULAR ARC METHOD
END OF CONSTRUCTION CONDITIONS

INV NO | DATED
CONTR NO
DRAWING NUMBER | SHEET NO OF | SEQUENCE NO



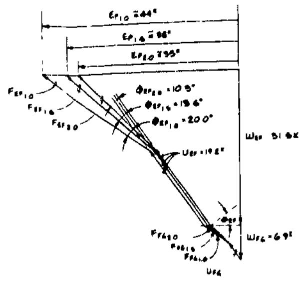
ACTIVE WEDGE FORCE POLYGON

SCALE IN KIPS



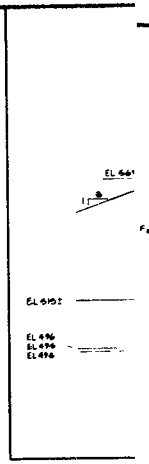
CENTRAL BLOCK FORCE POLYGON

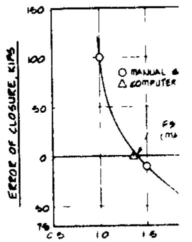
SCALE IN KIPS



PASSIVE WEDGE FORCE POLYGON

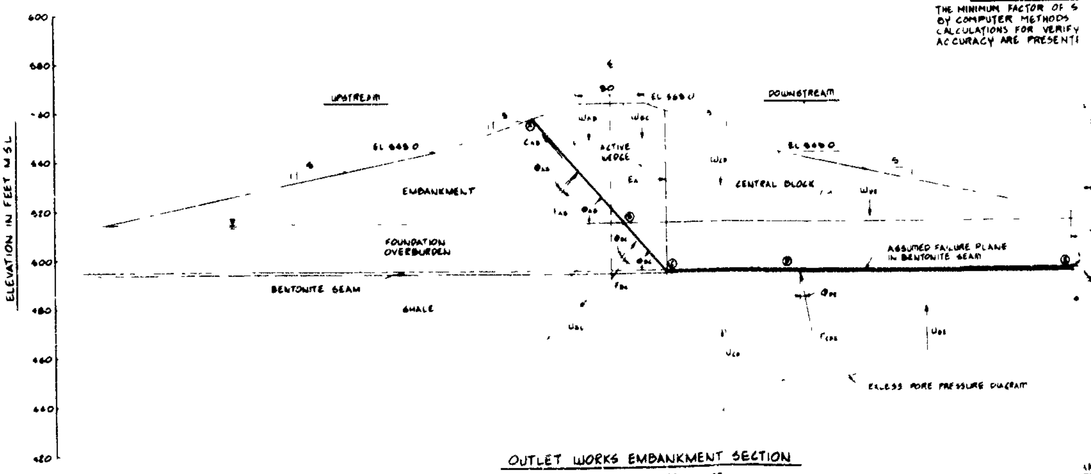
SCALE IN KIPS





TRIAL FACTOR OF

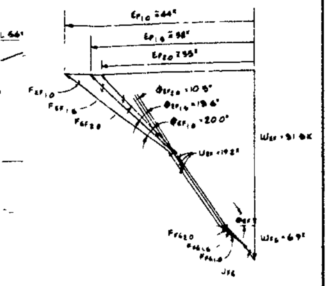
THE MINIMUM FACTOR OF S
BY COMPUTER METHODS
CALCULATIONS FOR VERIFY
ACCURACY ARE PRESENT



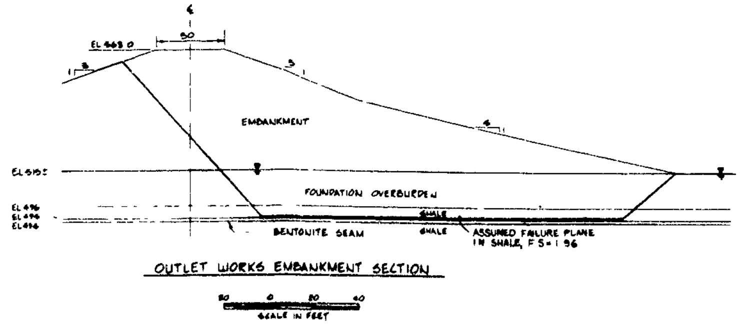
OUTLET WORKS EMBANKMENT SECTION

SCALE IN FEET

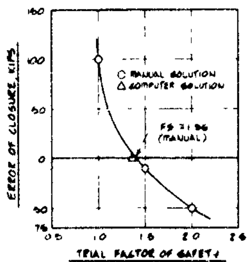
US ARMY



PASSIVE WEDGE FORCE POLYGON



OUTLET WORKS EMBANKMENT SECTION



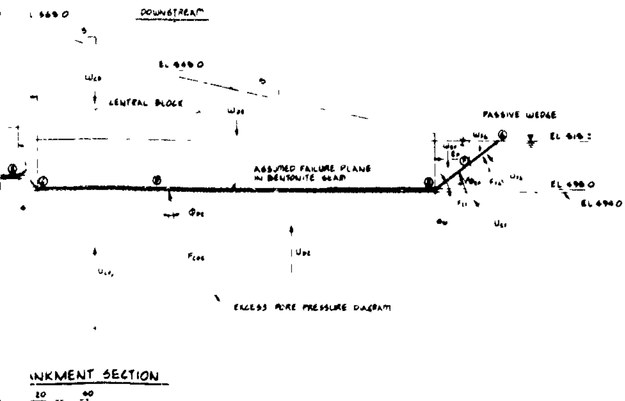
THE MINIMUM FACTOR OF SAFETY CALCULATED BY COMPUTER METHODS IS 1.34. MANUAL CALCULATIONS FOR VERIFYING COMPUTER ACCURACY ARE PRESENTED ON THIS PLATE

ADOPTED DESIGN PARAMETERS

PROPERTY \ MATERIAL		EMBANKMENT	FOUNDATION OVERBURDEN	BENTONITE SEAM
UNIT WEIGHT PCF	MOIST	125.0	129.0	126.0
	SATURATED	129.0	130.0	130.0
	SUBMERGED	66.6	67.6	67.6
S STRENGTH	C tsf	NA	0.0	0.0
	Ø deg	NA	20.0	18.0
Q STRENGTH	C tsf	1.4	NA	NA
	Ø deg	1.5	NA	NA

NOTES

1. THE ANALYSES WERE CONDUCTED ASSUMING 50% EXCESS PORE PRESSURE IN THE FOUNDATION, S-STRENGTH IN THE FOUNDATION AND Q-STRENGTH IN THE EMBANKMENT
2. THE ELEVATION OF THE EMBANKMENT CREST HAS BEEN CHANGED TO EL 564.5, AND THE UPPER 1V ON 3H SLOPES HAVE BEEN CHANGED TO 1V ON 2.8H SINCE THESE ANALYSES WERE PERFORMED. THESE CHANGES ARE CONSIDERED TOO SLIGHT TO RE-ANALYZE THE SECTION



...NKMENT SECTION

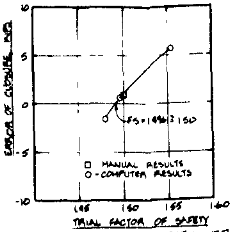
U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT AND SPILLWAY
OUTLET WORKS EMBANKMENT SECTION
STABILITY ANALYSES
WEDGE METHOD
END OF CONSTRUCTION CONDITIONS WITH 50% EXCESS PORE PRESSURE IN FOUNDATION

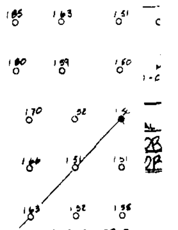
DESIGNED BY | DRAWN BY RLH | CHECKED BY
INV NO | DATED | CONTR NO | DRAWING NUMBER | SHEET NO | SEQUENCE NO

CORPS OF ENGINEERS

SLICE NO.	AREA	WEIGHT, KIPS: MOIST	SATURATED	SUBMERGED	TOTAL	ΔL BASE LENGTH	UPLIFT, U_B (KIPS)	$U_L - U_R$ (KIPS)
1	[illegible]	12.8	-	-	12.8	19.6	-	-
2	292.3	31.9	-	-	31.9	19.6	-	-
3	346.5	43.5	-	-	43.5	19.6	-	-
4	[illegible]	66.1	-	-	66.1	21.9	-	-
5	161.5	20.2	-	-	21.1	5.9	0.4	0.2
5'	6.8	-	0.9	-				
6	141.8	17.7	-	-	20.1	4.9	0.9	0.5
6'	11.9		1.6	-				
6"	6.9		0.9	-				
7	366.8	43.9	-	-	59.3	15.6	6.7	1.8
7'	30.8	-	4.0	-				
7"	[illegible]	-	9.4	-				
8	[illegible]	42.8	-	-	63.0	15.6	11.3	3.7
8'	28.6	-	3.7	-				
8"	144.8	-	18.8	-				
9	[illegible]	35.4	-	-	65.9	15.6	15.3	3.0
9'	[illegible]	-	3.8	-				
9"	210.0	-	27.8	-				
10	285.0	[illegible]	-	-	66.6	15.6	17.6	2.0
10'	15.5	-	2.5	-				
10"	261.3	-	38.7	-				
11	302.9	26.3	-	-	65.2	15.6	19.0	1.5
11'	16.8	-	2.0	-				
11"	270.0	-	36.9	-				
12	172.8	20.0	-	-	58.7	13.7	17.0	0.2
12'	13.5	-	1.7	-				
12"	280.0	-	37.0	-				
13	[illegible]	16.8	-	-	52.5	13.7	16.4	1.6
13'	9.0	-	1.2	-				
13"	270.0	-	36.3	-				
14	[illegible]	14.9	-	-	44.0	13.7	14.9	2.9
14'	3.8	-	0.5	-				
14"	260.0	-	35.3	-				
15	30.0	4.4	-	-	41.7	21.9	19.4	3.8
15'	1.0	-	0.1	-				
15"	262.0	-	36.7	-				
16	211.8	-	-	14.3	14.3	27.1	-	6.5



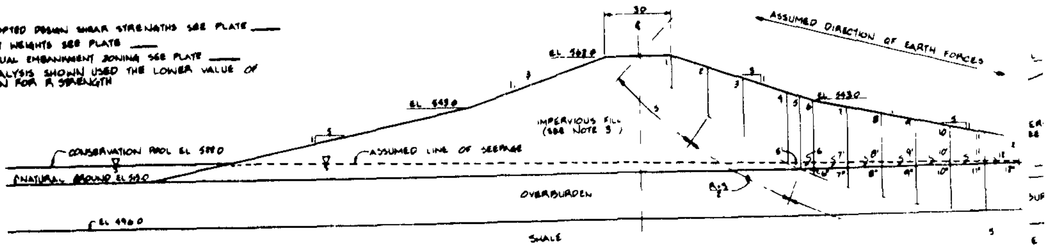
TRIAL FACTOR OF SAFETY VERSUS ERROR OF CLOSURE



COMPUTER GRID
OF SAFETY FOR
EL 496.0 AND
SEEPAGE AS S

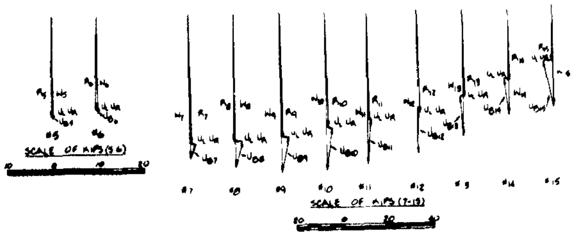
NOTES:

1. FOR ADOPTED DESIGN SHEAR STRENGTHS SEE PLATE ____
2. FOR UNIT WEIGHTS SEE PLATE ____
3. FOR ACTUAL EMBANKMENT ZONING SEE PLATE ____
4. THE ANALYSIS SHOWN USED THE LOWER VALUE OF COHESION FOR R STRENGTH

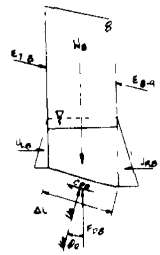


OUTLET WORKS EMBANKMENT SECTION

SCALE IN FEET



RESULTANTS OF WEIGHT AND WATER FORCES ON SLICE



SLOPING WATER SURFACE (SLICES 5-15)
TOTAL WEIGHTS USED

TYPICAL
NOT TO

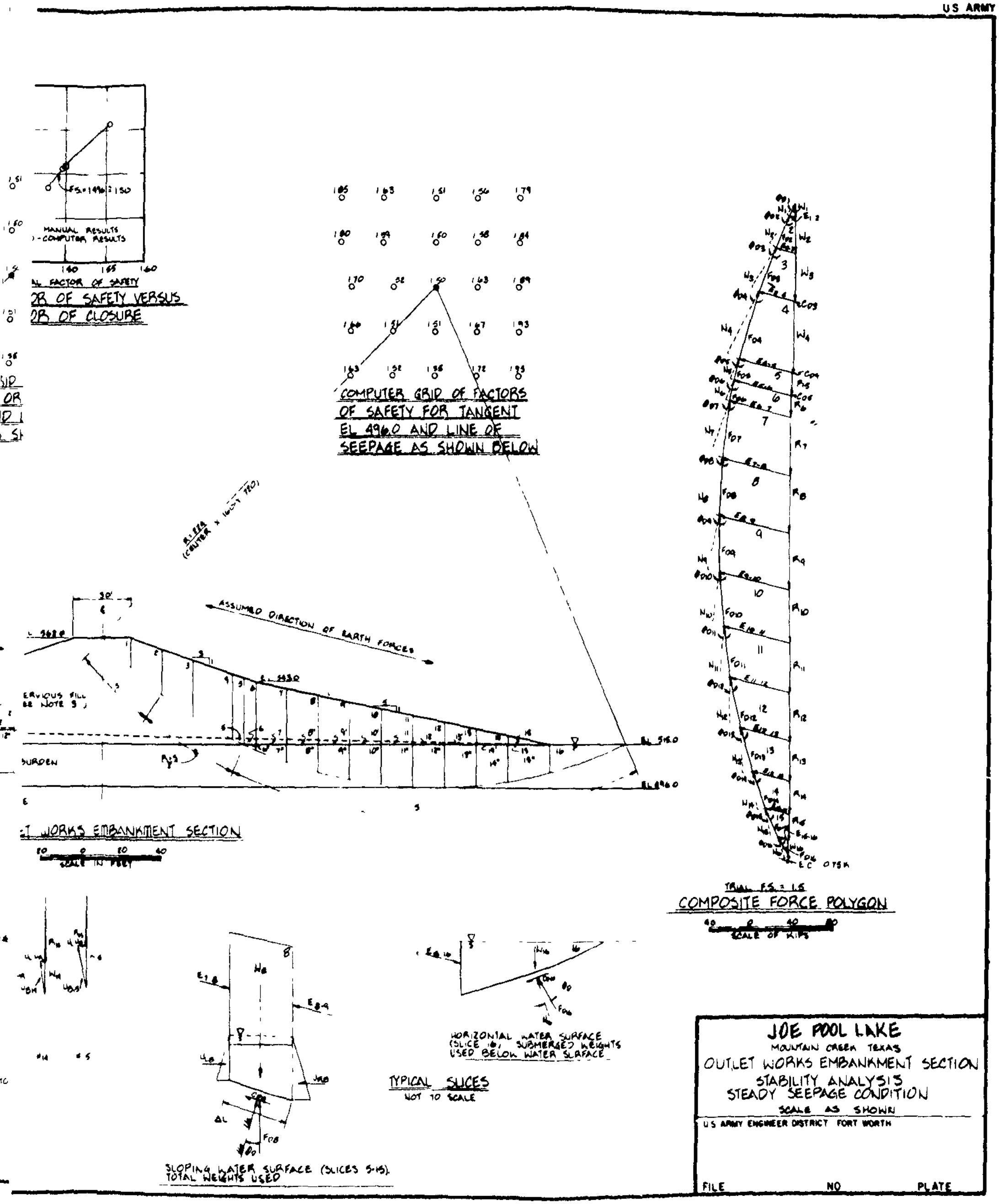
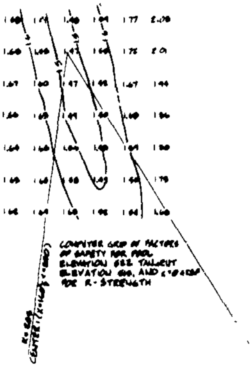
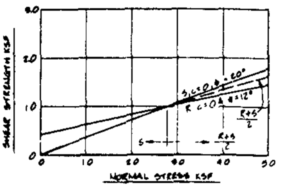
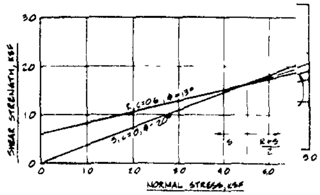

US ARMY
FACTOR OF SAFETY VERSUS
OR OF CLOSURE
MANUAL RESULTS
COMPUTER RESULTS
COMPUTER GRID OF FACTORS
OF SAFETY FOR TANGENT
EL 496.0 AND LINE OF
SEEPAGE AS SHOWN BELOW
ASSUMED DIRECTION OF EARTH FORCES
EL 545.0
EL 515.0
EL 496.0
WORKS EMBANKMENT SECTION
SCALE IN FEET
TRIAL F.S. = 1.5
COMPOSITE FORCE POLYGON
SCALE OF KIPS
SLOPING WATER SURFACE (SLICES 5-15).
TOTAL WEIGHTS USED
HORIZONTAL WATER SURFACE
(SLICE 16), SUBMERGED WEIGHTS
USED BELOW WATER SURFACE
TYPICAL SLICES
NOT TO SCALE
JOE POOL LAKE
MOUNTAIN CREEK TEXAS
OUTLET WORKS EMBANKMENT SECTION
STABILITY ANALYSIS
STEADY SEEPAGE CONDITION
SCALE AS SHOWN
U S ARMY ENGINEER DISTRICT FORT WORTH
FILE
NO
PLATE

PLATE 60

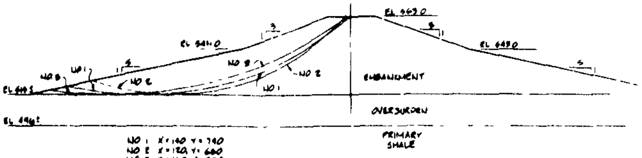




EMBANKMENT
COMPOSITE STRENGTH ENVELOPE



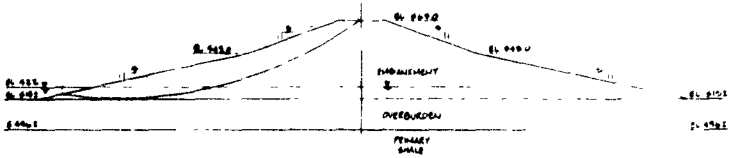
OVERBURDEN
COMPOSITE STRENGTH ENVELOPE



OUTLET WORKS EMBANKMENT SECTION

FIGURE NO 2

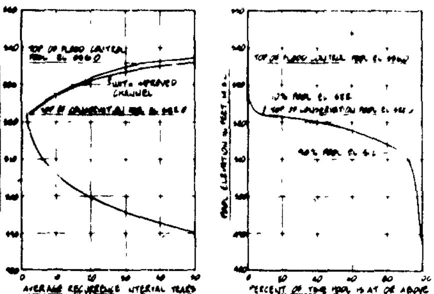
SCALE OF FEET



OUTLET WORKS EMBANKMENT SECTION

FIGURE NO 3

SCALE OF FEET

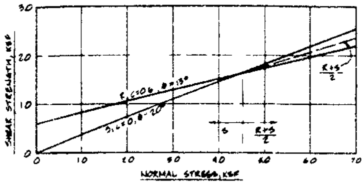


NOTES
CURVES BASED UPON PERIOD OF RECORD JANUARY 1934 TO 30 SEPTEMBER 1960
2 CURVES BASED UPON HYPOTHETICAL LAKE REGULATION AFTER 100 YEARS OF SEDIMENTATION
3 EL 590.0 HAS A RECURRENCE INTERVAL OF 100 YEARS

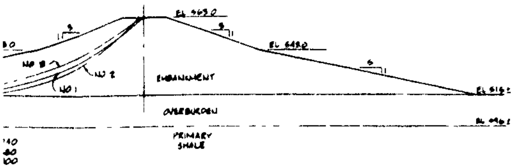
POOL ELEVATION PROBABILITY
AND DURATION CURVES

WEDGE NO	AREA	WEIGHT KIPS SUBMERGED	SATURATED	MOIST	TOTAL	CL BASE LENGTH	UPLIFT (KIPS)	[illegible] (KIPS)
[illegible]	[illegible]			[illegible]	[illegible]	8.00		-
2	[illegible]		-	[illegible]	[illegible]	17.80		-
3	[illegible]			[illegible]	[illegible]	7.80		
4	[illegible]		-	[illegible]	[illegible]	[illegible]		
5	[illegible]			[illegible]	[illegible]	[illegible]		
6	[illegible]			[illegible]	[illegible]	[illegible]		
7	[illegible]			[illegible]	[illegible]	8.00	[illegible]	[illegible]
7	[illegible]		7.28					
8	[illegible]			[illegible]	[illegible]	[illegible]	12.[illegible]	[illegible]
8	[illegible]		[illegible]					
9	[illegible]	[illegible]			[illegible]	10.00		
10	[illegible]	[illegible]	-		[illegible]	[illegible]		
11	[illegible]	[illegible]			[illegible]	[illegible]		
12	[illegible]	[illegible]			[illegible]	14.00		

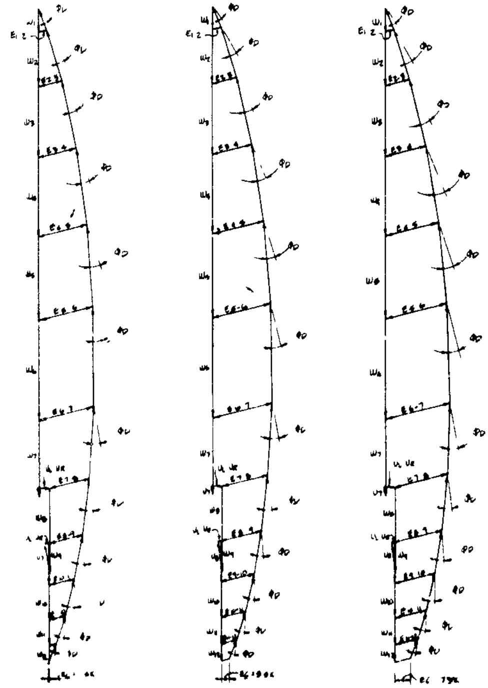
NOTES
FOR UNIT WEIGHTS SEE PLATE
2 SEE TEXT FOR DISCUSSION OF ANALYSES SHOWN ON THIS PLATE



OVERBURDEN
COMPOSITE STRENGTH ENVELOPE

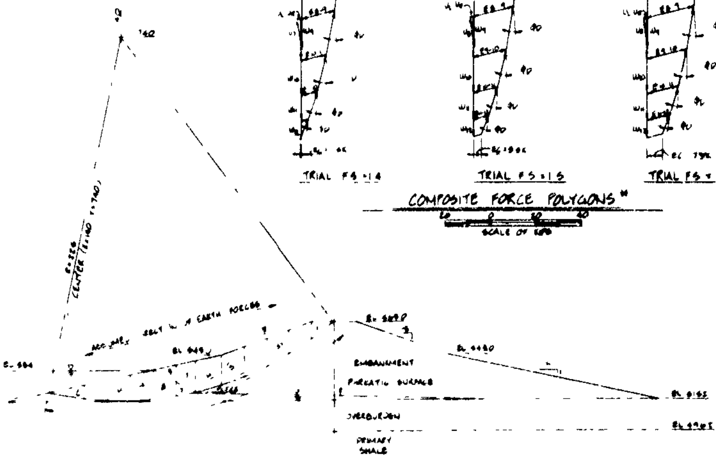


OUTLET WORKS EMBANKMENT SECTION
FIGURE NO 2
SCALE OF FEET



COMPOSITE FORCE POLYGONS *
SCALE OF KIPS

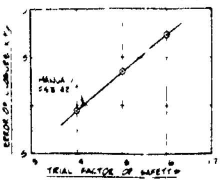
WEIGHT KIPS SATURATED	MOIST	TOTAL	BASE LENGTH	UPLIFT (KIPS)	U_L U_R (KIPS)
	[illegible]	[illegible]	[illegible]		—
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
	4.49	4.49	[illegible]		
7.28	14.90	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4.00	[illegible]	4.00	[illegible]	48
		[illegible]	[illegible]		
		[illegible]	6.20		
		[illegible]	6.20		
		[illegible]	24.00		



OUTLET WORKS EMBANKMENT SECTION *
FIGURE NO 1
SCALE OF FEET

NOTES
1 FOR UNIT WEIGHTS SEE PLATE
2 SEE TEXT FOR DISCUSSION OF ANALYSES SHOWN ON THIS PLATE

* FOR THE FAILURE SURFACE IN FIG NO 1, A [illegible] KSF FOR C STRENGTH WAS USED IN THIS ANALYSIS

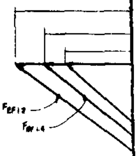


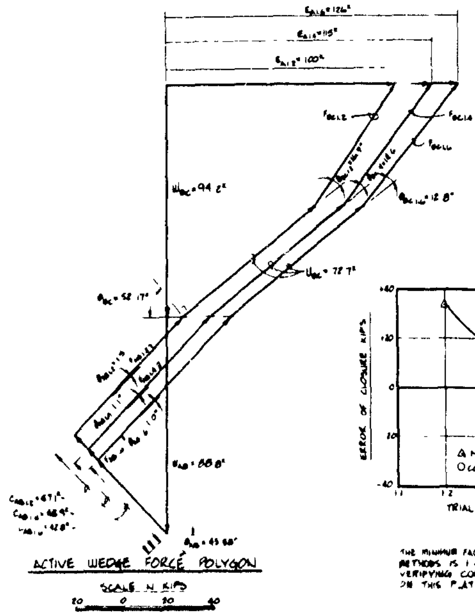
JOE POOL LAKE
MOUNTAIN CREEK TEXAS

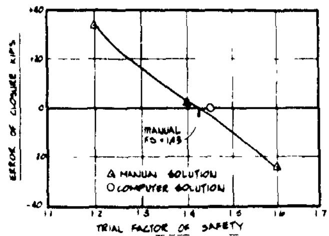
OUTLET WORKS EMBANKMENT SECTION
STABILITY ANALYSIS
PARTIAL POOL CONDITION

US ARMY ENGINEER DISTRICT FORT WORTH

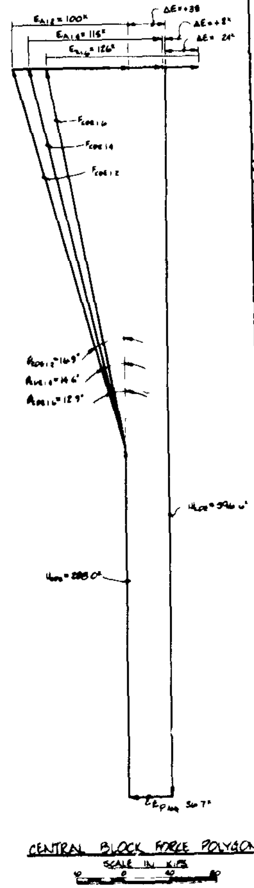
FILE NO PLATE

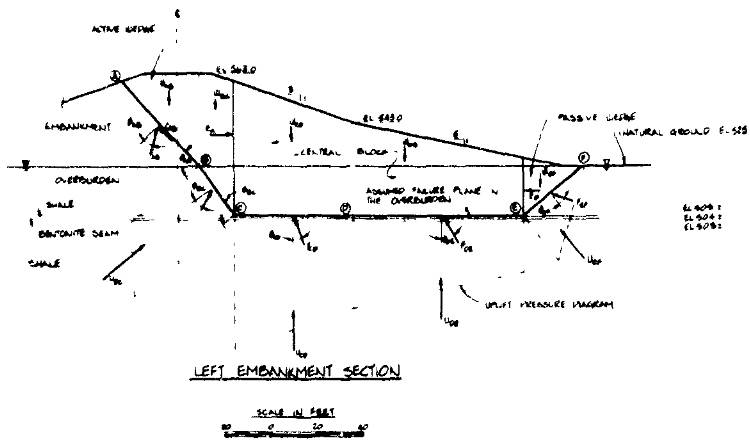


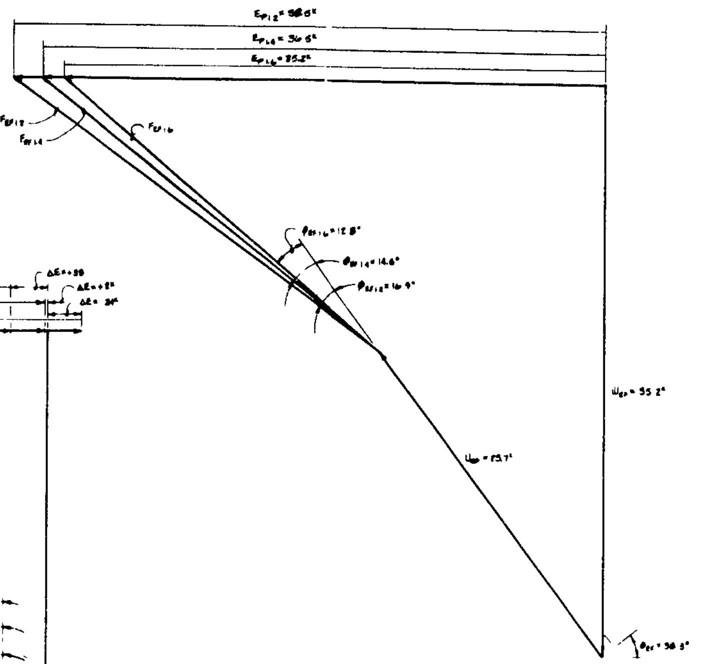




THE MINIMUM FACTOR OF SAFETY CALCULATED BY COMPUTER METHODS IS 1.45. MANUAL CALCULATIONS FOR VERIFYING COMPUTER ACCURACY ARE PRESENTED ON THIS PLATE

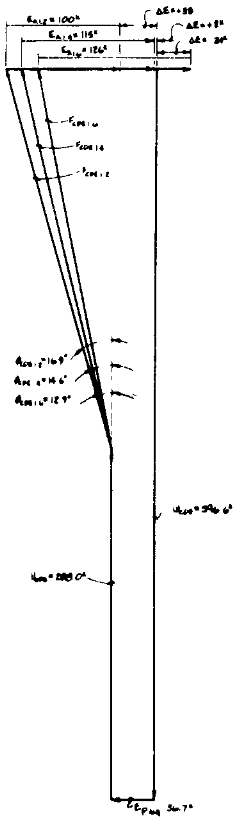






PASSIVE WEDGE FORCE POLYGON

SCALE IN KIPS



CENTRAL BLOCK FORCE POLYGON

SCALE IN KIPS

ALCULATED BY COMPUTER
ALCULATIONS FOR
Y ARE PRESENTED

GROUND EL 525

NOTES

1. SEE PLATE FOR ADOPTED SHEAR STRENGTHS AND UNIT WEIGHTS
2. THE ELEVATION OF THE EMBANKMENT CREST HAS BEEN CHANGED FROM 568.0 TO 564.5 AND THE SLOPES OF THE UPPER 21.5 FEET OF THE EMBANKMENT HAVE BEEN CHANGED FROM 1 VERTICAL ON 3 HORIZONTAL TO 1 VERTICAL ON 2.5 HORIZONTAL SINCE THESE ANALYSES WERE COMPLETED. THESE CHANGES ARE CONSIDERED TOO SLIGHT TO RE ANALYZE THESE SECTIONS
3. THE ANALYSES WERE CONDUCTED ASSUMING 50% EXCESS PORE PRESSURE IN THE FOUNDATION, S-STRENGTH IN THE FOUNDATION, AND Q STRENGTH IN THE EMBANKMENT

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT AND SPILLWAY
LEFT EMBANKMENT SECTION
STABILITY ANALYSES
WEDGE METHOD
END OF CONSTRUCTION CONDITIONS
WITH 50% EXCESS PORE PRESSURE
IN FOUNDATION

DESIGNED BY

DRAWN BY MGA

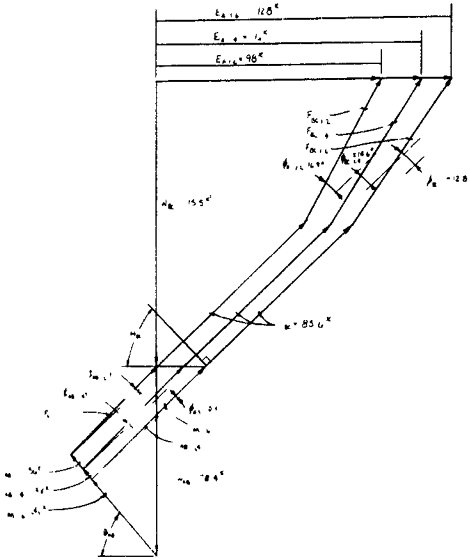
CHECKED BY

INV NO

DATED

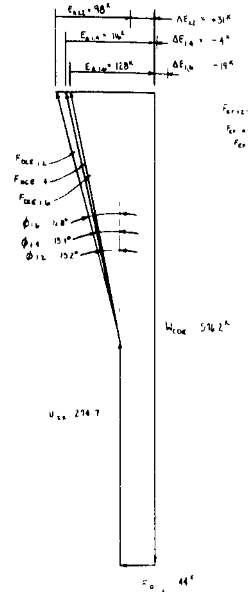
DRAWING NUMBER

SHEET NO



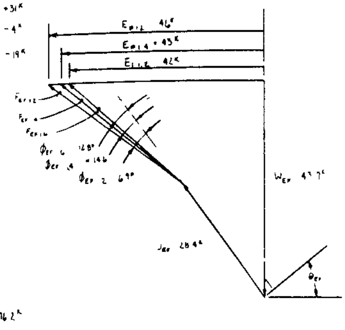
ACTIVE WEDGE FORCE POLYGON

SCALE IN KIPS



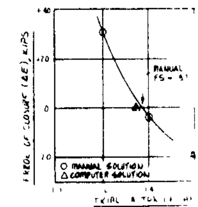
CENTRAL BLOCK FORCE POLYGON

SCALE IN KIPS

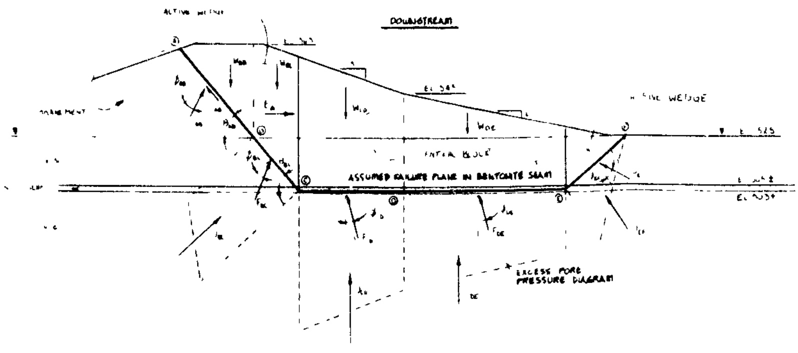


PASSIVE WEDGE FORCE POLYGON

SCALE IN KIPS

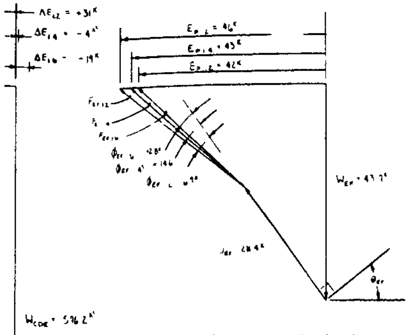


THE MINIMUM FACTOR OF SA
CALCULATED BY COMPUTER
≤ 1.35 MANUAL CALCU
FOR VERIFYING COMPUTER
ARE PRESENTED IN THI



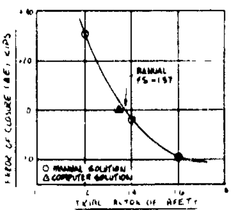
LEFT EMBANKMENT SECTION

SCALE IN FEET

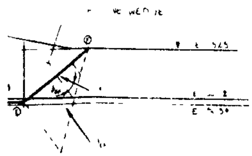


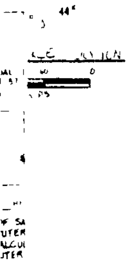
PASSIVE WEDGE FORCE POLYGON

SCALE IN KIPS



THE MINIMUM FACTOR OF SAFETY CALCULATED BY COMPUTER METHODS IS 1.55. MANUAL CALCULATIONS FOR VERIFYING COMPUTER ACCURACY ARE PRESENTED IN THIS PLATE





ADOPTED DESIGN PARAMETERS

PROPERTY		EMBANKMENT	FOUNDATION OVERBURDEN	BENTONITE FM
UNIT WT PCF	MOIST	125.0	129.0	125.0
	SATURATED	129.0	130.0	130.0
	SUBMERGED	66.5	67.5	67.5
S-STRENGTH	C PSF	NA	0.0	0.0
	ϕ DEG	NA	20.0	18.0
Q-STRENGTH	C PSF	4	NA	NA
	ϕ DEG	15	NA	NA

NOTES

1. THE ANALYSES WERE CONDUCTED ASSUMING 50% EXCESS PORE PRESSURE IN THE FOUNDATION, S STRENGTH IN THE FOUNDATION, AND Q STRENGTH IN THE EMBANKMENT
2. THE ELEVATION OF THE EMBANKMENT CREST HAS BEEN CHANGED FROM 563.0 TO 564.5, AND THE UPPER 1 VERTICAL TO 3 HORIZONTAL SLOPES HAVE BEEN CHANGED TO 1 VERTICAL TO 2.8 HORIZONTAL SINCE THESE ANALYSES WERE PERFORMED. THESE CHANGES ARE CONSIDERED TOO SLIGHT TO RE-ANALYZE THESE SECTIONS

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT AND SPILLWAY
LEFT EMBANKMENT SECTION
STABILITY ANALYSES
WEDGE METHOD
END OF CONSTRUCTION CONDITIONS WITH 50% EXCESS PORE PRESSURE IN FOUNDATION

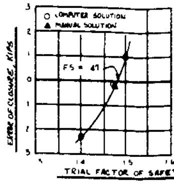
PLATE 63

FIGURE 3

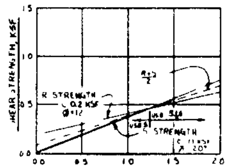
SLICE PARAMETERS*

SLICE NO.	SLICE HT, ft LEFT	SLICE HT, ft RT	SLICE HT, ft AVG	HORIZ WIDTH ft	AREA ft²	UNIT WEIGHT, k/ft³	SLICE WEIGHT, k	BASE LENGTH ft	C_D, k (FS 1.47)	ϕ_D (FS = 1.47)
1	0	8	4	9	36	0.125	4.5	12	0	13.9°
2	8	14	11	20	220	0.125	27.5	25	2.5	12
3	14	17	16	20	320	0.125	40.0	24	2.4	11.2°
4	17	16	16	20	320	0.125	40.0	20	2.0	11.2
5	16	14	15	18	270	0.125	33.8	18	8	11.2
6	14	11	12	17	204	0.125	25.5	19	1.9	11.2°
7	11	0	6	21	110	0.125	14.0	29	0	13.9°

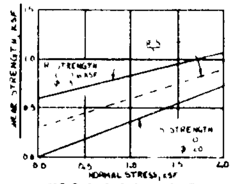
* FOR FAILURE SURFACE SHOWN IN FIGURE 1



THE MINIMUM FACTOR OF SAFETY CALCULATED BY COMPUTER METHODS IS 1.47. MANUAL CALCULATIONS FOR VERIFYING COMPUTER ACCURACY ARE PRESENTED ON THIS PLATE



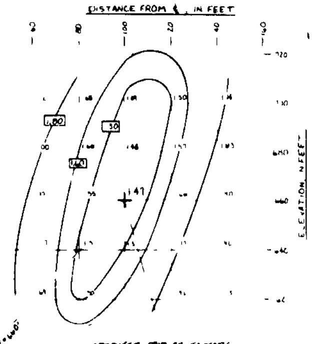
EMBANKMENT SHEAR STRENGTH



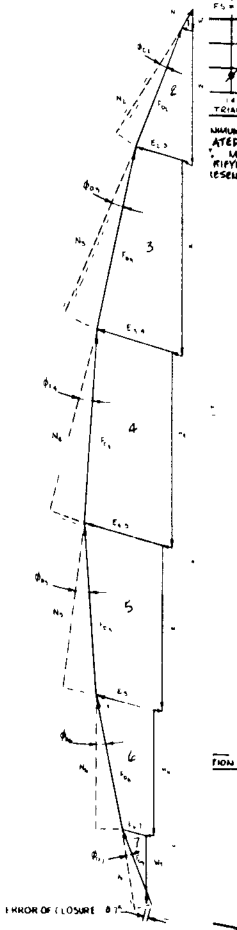
OVERBURDEN SHEAR STRENGTH

ADOPTED STRENGTH PARAMETERS

FIGURE 2



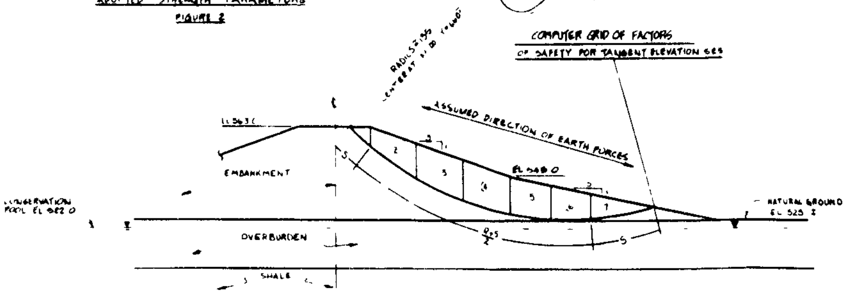
COMPUTER GRID OF FACTORS OF SAFETY FOR TANGENT ELEVATION 525



COMPOSITE FORCE POLYGON FOR FS = 1.47

SCALE IN KIPS

FIGURE 5

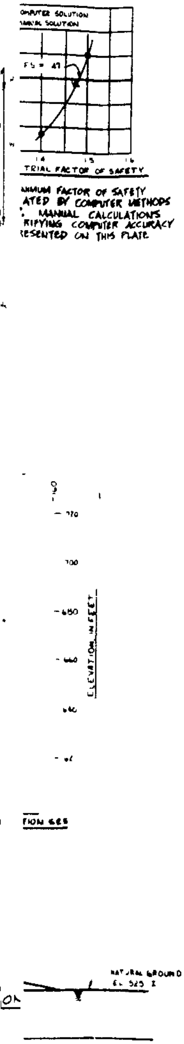


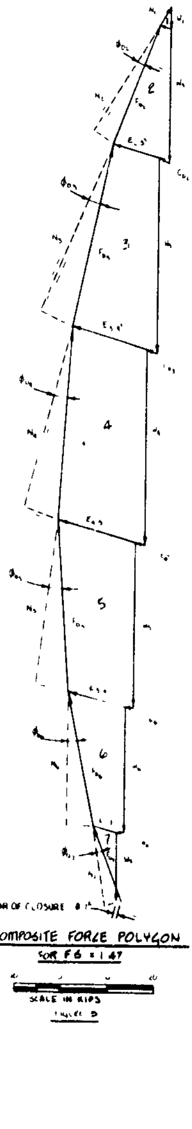
CASE 1 FAILURE THROUGH EMBANKMENT

FS = 1.47

FIGURE 1

SCALE IN FEET





COMPOSITE FORCE POLYGON
FOR FS = 1.47

FIGURE 5

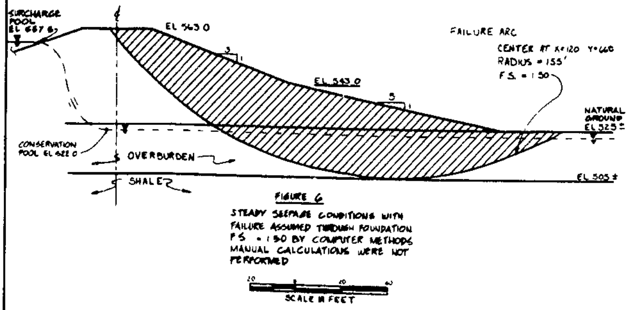


FIGURE 6

STEADY SEEPAGE CONDITIONS WITH FAILURE ASSUMED THROUGH FOUNDATION F.S. = 1.50 BY COMPUTER METHODS MANUAL CALCULATIONS WERE NOT PERFORMED

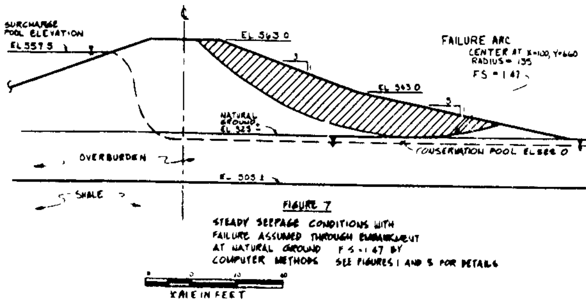


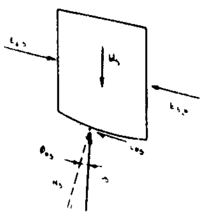
FIGURE 7

STEADY SEEPAGE CONDITIONS WITH FAILURE ASSUMED THROUGH EMBANKMENT AT NATURAL GROUND F.S. = 1.47 BY COMPUTER METHODS SEE FIGURES 1 AND 5 FOR DETAILS

NOTES

1. THE ELEVATION OF THE EMBANKMENT CREST HAS BEEN CHANGED FROM 563.0 TO 564.5, AND THE SLOPES OF THE UPPER 21.0 FEET OF THE EMBANKMENT HAVE BEEN CHANGED FROM 1 VERTICAL ON 3 HORIZONTAL TO 1 VERTICAL ON 2.8 HORIZONTAL SINCE THESE ANALYSIS WERE COMPLETED. THESE CHANGES ARE CONSIDERED TOO SLIGHT TO RE ANALYZE THESE SECTIONS

2. AS INDICATED IN FIGURES 6 AND 7, THE SURCHARGE POOL DOES NOT CHANGE THE LOCATION OF THE CRITICAL CIRCULAR FAILURE SURFACES



TYPICAL SLICE FORCES

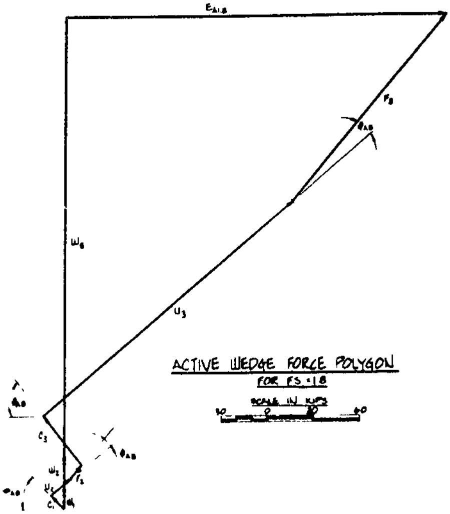
FIGURE 4 NTS

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT AND SPILLWAY
LEFT EMBANKMENT SECTION
STABILITY ANALYSES
CIRCULAR ARC METHOD
STEADY SEEPAGE CONDITIONS

DESIGNED BY
DRAWN BY MES
CHECKED BY

PLATE 64



ACTIVE WEDGE FORCE POLYGON

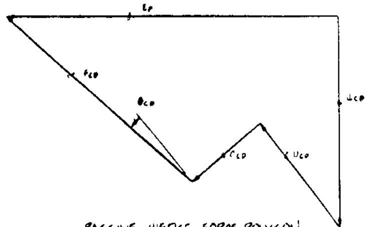
FOR FS = 1.8

SCALE IN KIPS

MAGNITUDES OF FORCE VECTORS

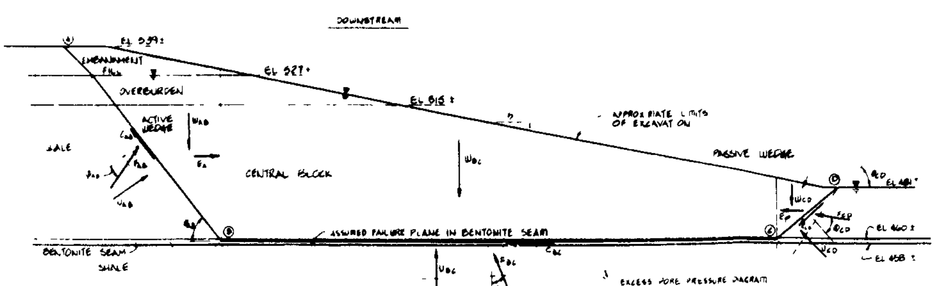
	VECTOR \ FS	1.4	1.6	1.8
ACTIVE WEDGE	W_1	9.0	9.0	9.0
	W_2	28.1	28.1	28.1
	W_3	272.0	272.0	272.0
	C_1	17.0	14.9	18.2
	C_2	0	0	0
	C_3	51.3	44.9	39.9
	U_1	0	0	0
	U_2	17.2	17.2	17.2
	U_3	208.6	208.6	208.6
	F_1	0	0	0
	F_2	16.6	15.8	10.0
	F_3	128.0	138.8	156.9
	E_A	218.3	238.0	247.3
PASSIVE WEDGE	W	43.8	43.8	43.8
	C	24.8	21.8	19.3
	U	28.2	28.2	28.2
	F	61.0	56.0	52.0
	E_P	84.0	77.2	71.7
CENTRAL BLOCK	W	1367.8	1367.8	1367.8
	C	0	0	0
	U	658.4	658.4	658.4
	F	932.0	729.0	714.0
	ΔE	+49.0	11.0	46.0

NOTE ALL VALUES IN KIPS



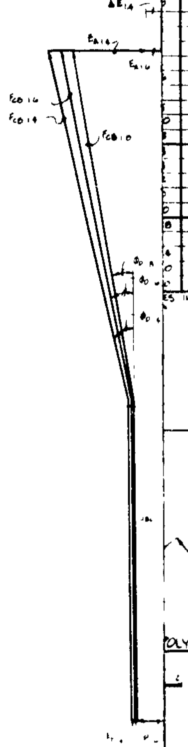
PASSIVE WEDGE FORCE POLYGON

SCALE IN KIPS



SECTION OF LEFT EMBANKMENT THROUGH SPILLWAY

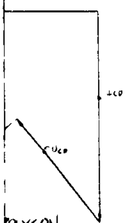
SCALE OF FEET



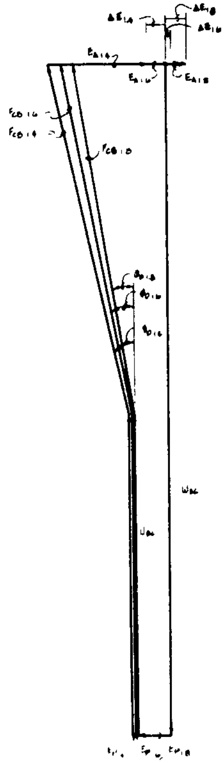
FORCE VECTORS

	1 6	1 8
	9 0	9.0
	281	251
	278 0	278.0
	14 9	18 2
	0	0
	44 9	39 9
	0	0
	17 2	17 2
	208 6	208.6
	0	0
	15 8	10 0
	138 8	156 9
	258 0	247 9
	43 8	43.8
	21 8	19 3
	28 2	28.2
	56.0	52 0
	77 2	71 7
	1367 8	1567 8
	0	0
	658 4	658 4
	729 0	714 0
	- 11 0	- 46 0

ES IN KIPS



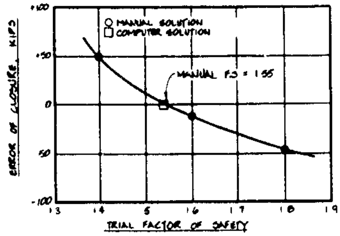
POLYGON



CENTRAL BLOCK FORCE POLYGON

SCALE IN KIPS

100 0 100 200

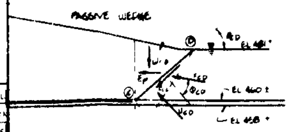


THE MINIMUM FACTOR OF SAFETY CALCULATED BY COMPUTER METHODS IS 1.54. MANUAL CALCULATIONS FOR VERIFYING COMPUTER ACCURACY ARE PRESENTED ON THIS PLATE

NOTE

1. THE ANALYSES WERE CONDUCTED ASSUMING 50% EXCESS PORE PRESSURE IN THE FOUNDATION, Q STRENGTH IN THE EMBANKMENT AND S STRENGTH IN THE FOUNDATION

ATE LIMITS
AVATION



PORE PRESSURE DIAGRAM

SPILLWAY

MATERIAL	δ(PCF)	C (KSF)	Φ
EMBANKMENT	125	4	15°
OVERBURDEN	130	0	20°
SHALE	130	1.0	18°
BENTONITE SEAM	113	0	18°

ADOPTED DESIGN PARAMETERS

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY

DRAWN BY MAD

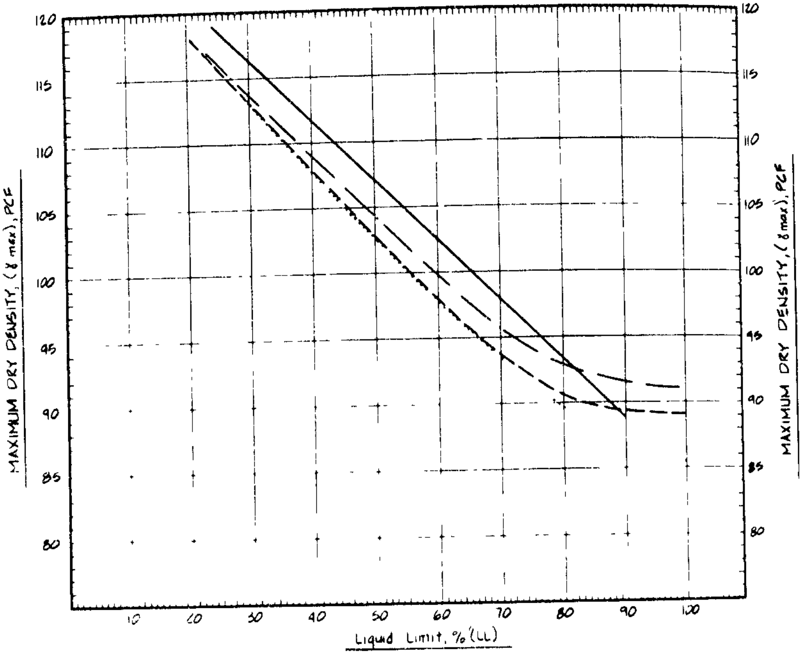
CHECKED BY

JOE POOL LAKE
MOUNTAIN CREEK TEXAS
EMBANKMENT AND SPILLWAY
LEFT EMBANKMENT SECTION NO 2 AT SPILLWAY
STABILITY ANALYSES
WEDGE METHOD
END OF CONSTRUCTION CONDITIONS WITH
50% EXCESS PORE PRESSURE IN FOUNDATION

INV NO

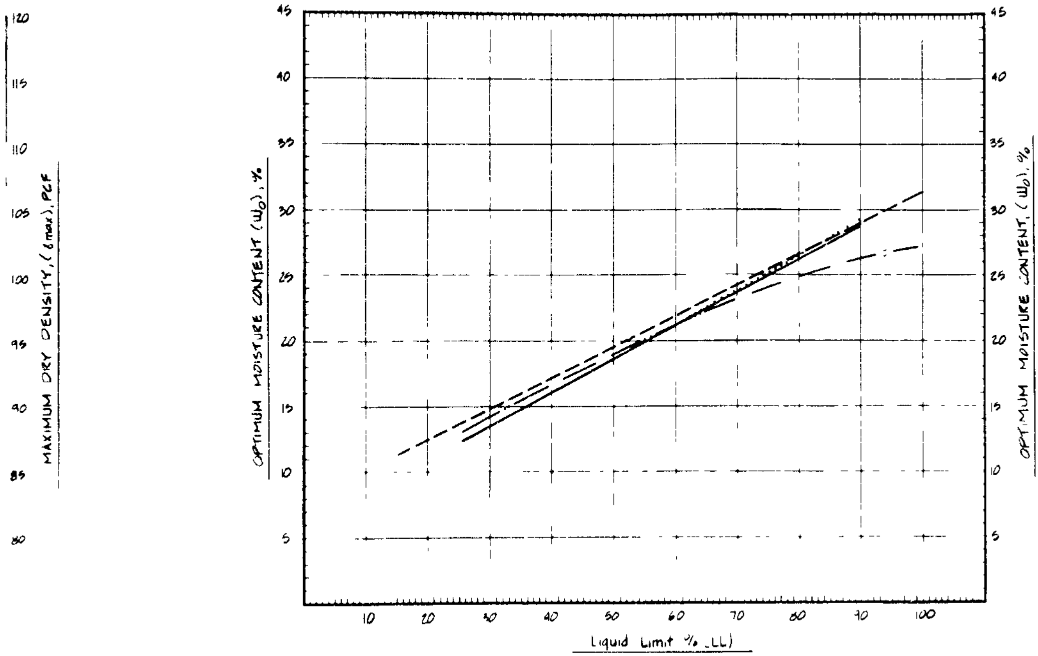
DATED

DRAWING NUMBER | SHEET NO



LIQUID LIMIT vs MAXIMUM DRY DENSITY

LEGEND



LIQUID LIMIT vs OPTIMUM MOISTURE CONTENT

LEGEND

ORIGINAL
19 MAY 80
6 OCT 80
15 JAN 81

SYM	DO. NO.	ACTION	DATE

DESIGNED BY

DRAWN BY

REVIEWED BY

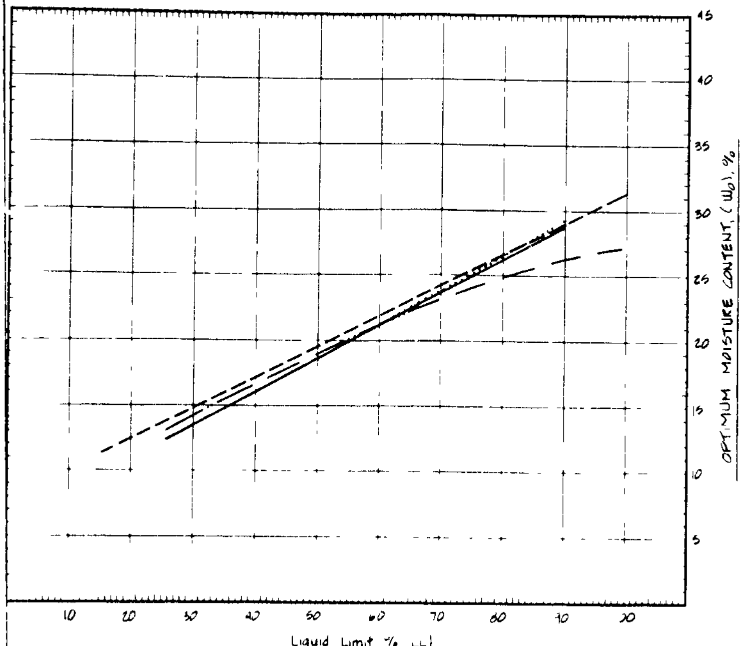
SUBMITTED BY

ENGINEER

LIQUID LIMI

INIT

PLATE



LIQUID LIMIT vs OPTIMUM MOISTURE CONTENT

SYMBOL	NO.	ACTION	DATE	DESCRIPTION OF REVISION

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY
DRAWN BY
REVIEWED BY

JOE POOL LAKE

LIQUID LIMIT CORRELATION CURVES

INITIAL CONTRACT

SUBMITTED BY

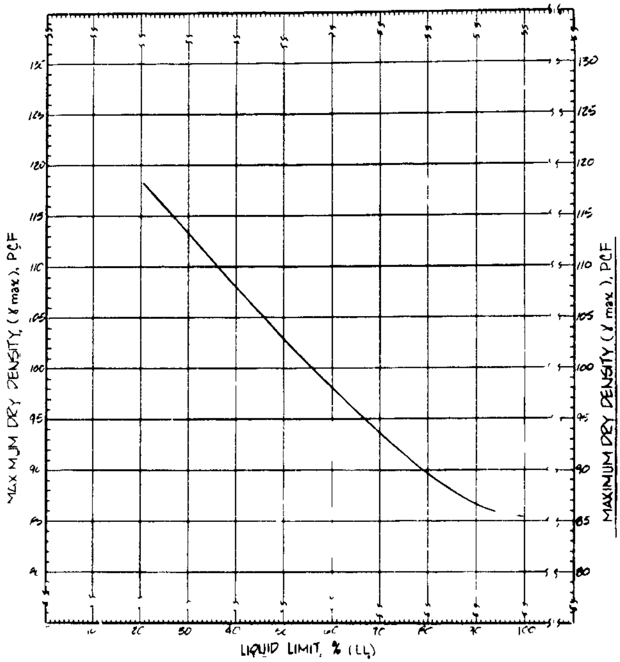
ENGINEER

INVITATION NO. | DATE

CONTRACT NO DACW63-80-C-0009

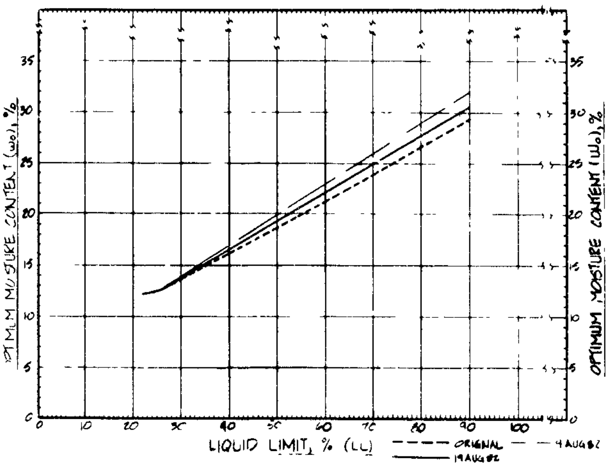
DRAWING NUMBER | SHEET NO OF | SEQUENCE NO

CONTRACT NO



LIQUID LIMIT vs MAXIMUM DRY DENSITY

NOTE MAXIMUM DRY DENSITY IN POUNDS/CUBIC FOOT (PCF) IS DETERMINED BY A STANDARD COMPACTION TEST



LIQUID LIMIT vs OPTIMUM MOISTURE CONTENT

NOTE

1. THE ORIGINAL CURVE WAS BASED ON DATA OBTAINED DURING THE FIRST CONTRACT.

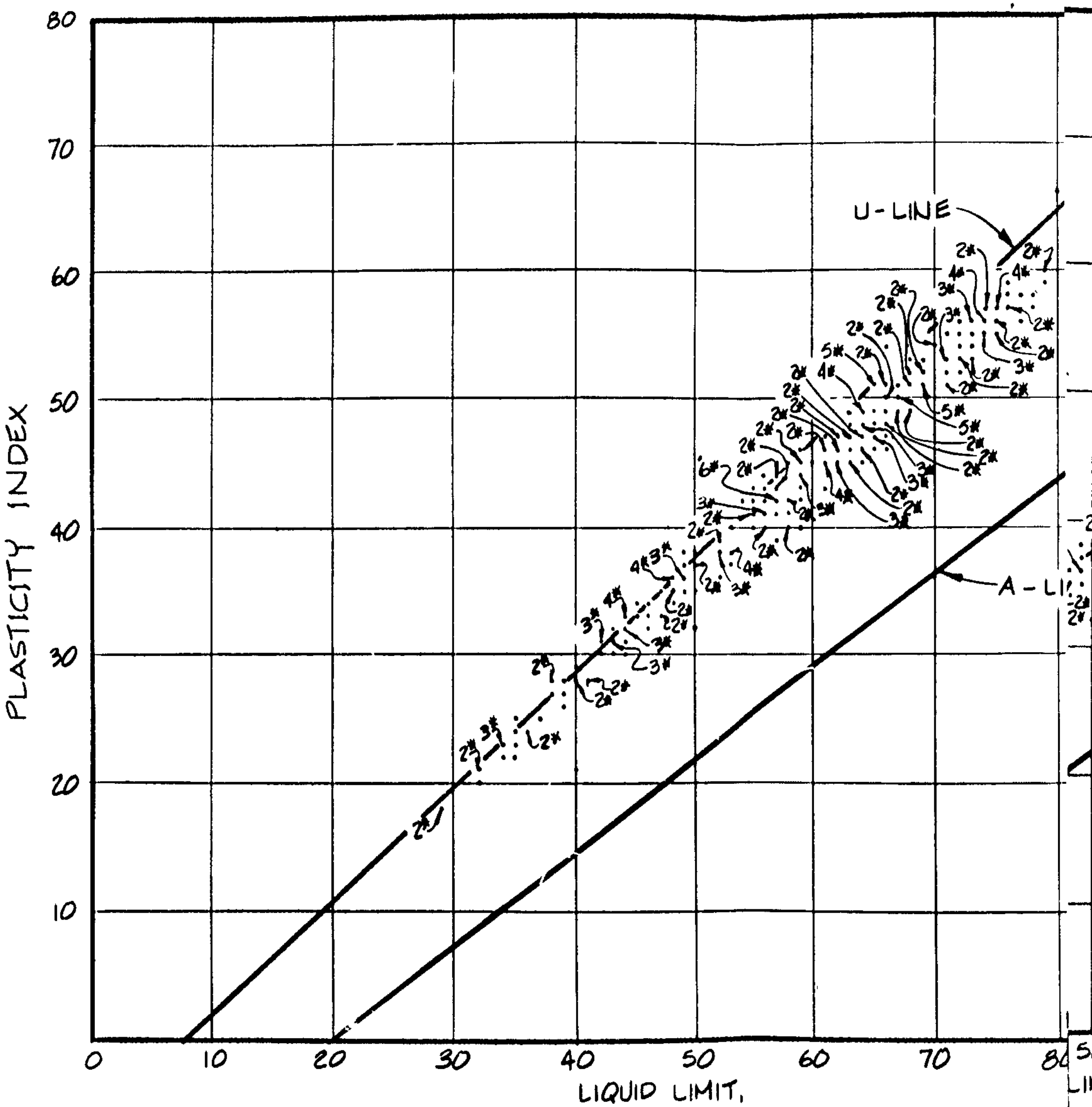
U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

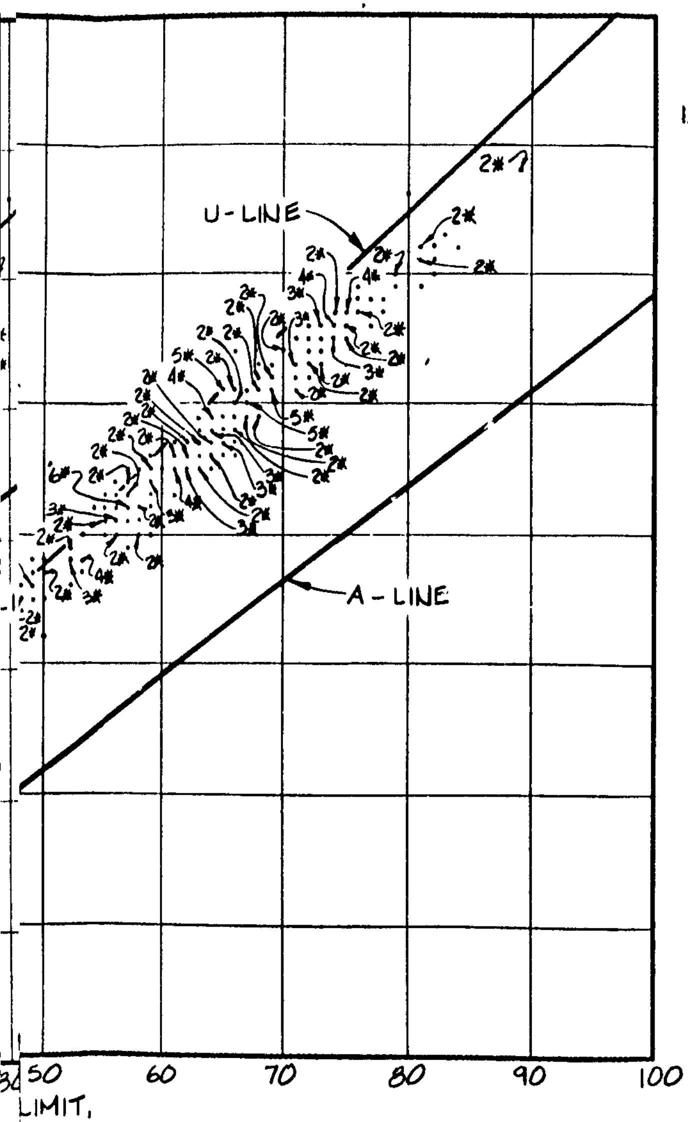
EMBANKMENT AND SPILLWAY
LIQUID LIMIT CORRELATION CURVES
COMPLETION CONTRACT

DESIGNED BY
DRAWN BY
CHECKED BY
SUBMITTED BY
CHIEF ENGR
DATED
CONTR NO DACW63 81 C-0141
DRAWING NUMBER
SHEET NO
OF
SEQUENCE NO

CORPS OF ENGINEERS



U.S ARMY



NOTE

1. THIS PLATE PRESENTS A SUMMARY FOR ALL BORROW AREAS.

* INDICATES NUMBER OF SAMPLES WITH SAME INDICES.

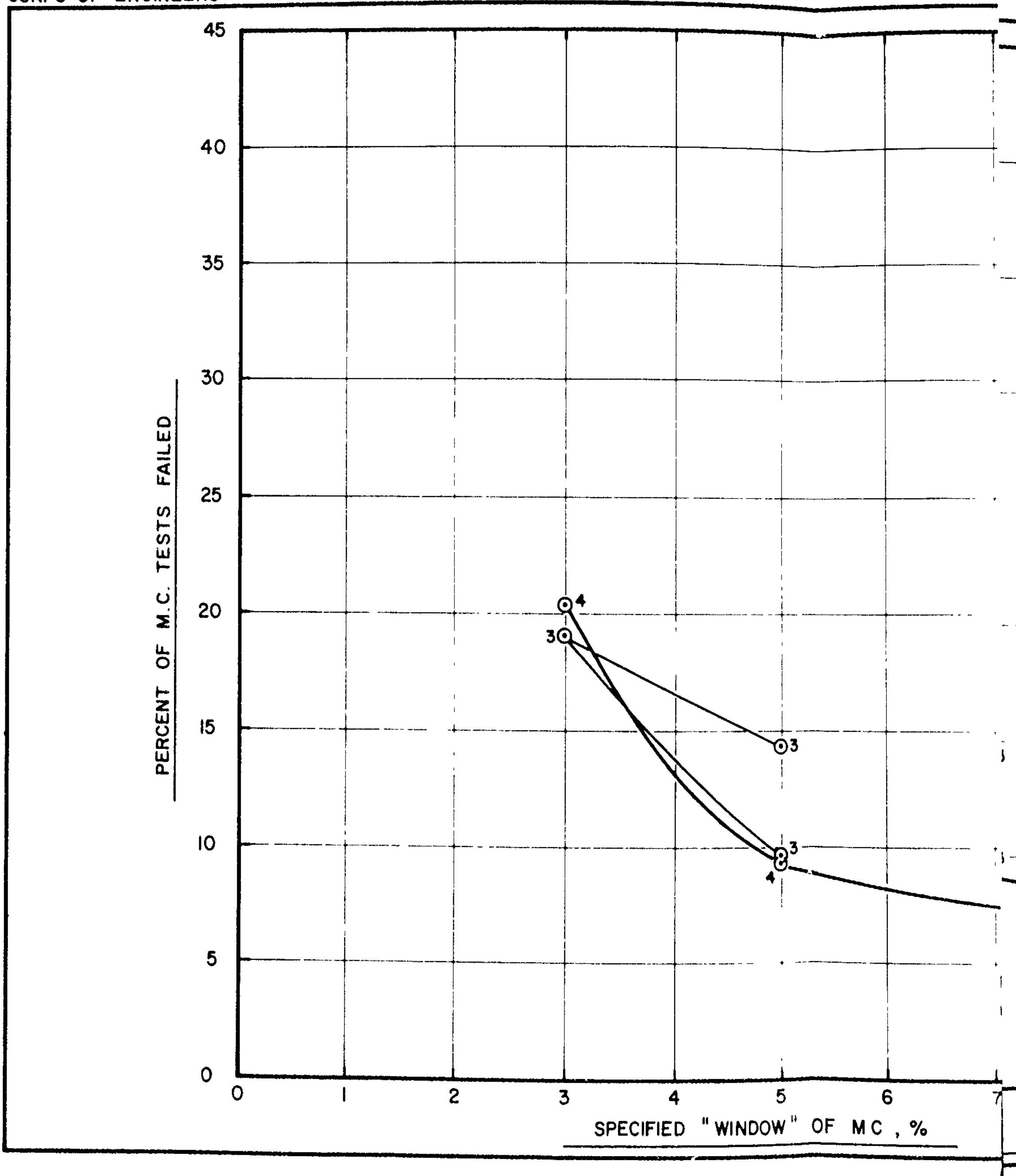
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

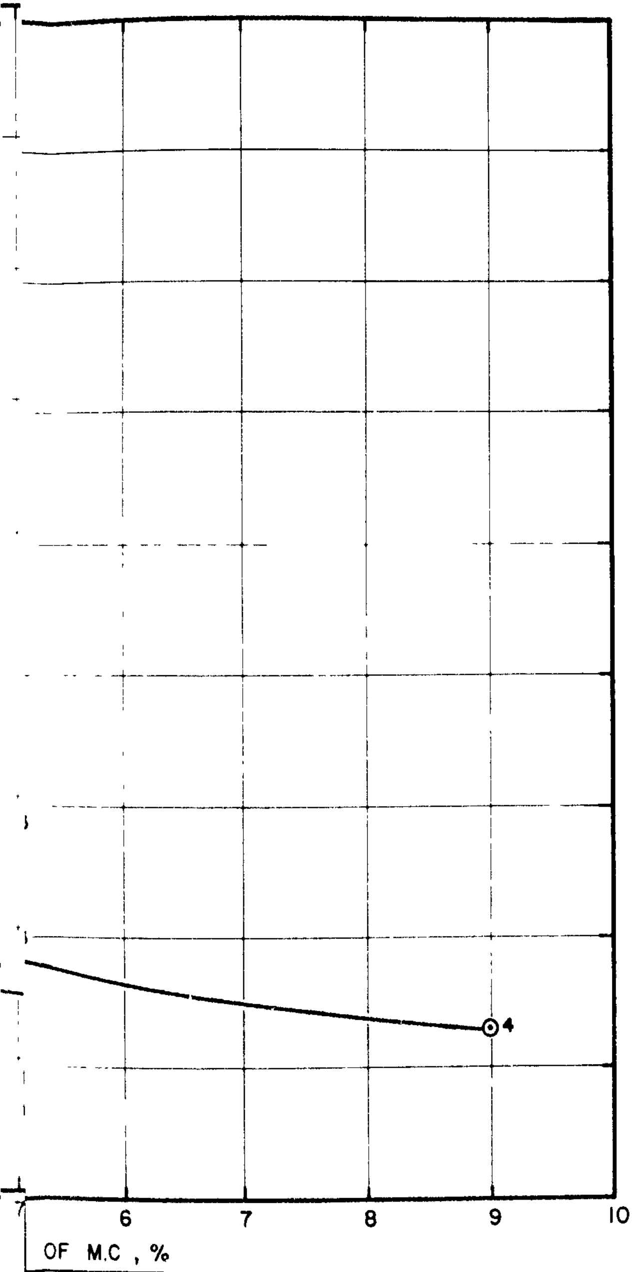
PLASTICITY CHART
BORROW AREAS

U S ARMY ENGINEER DISTRICT, FT WORTH

PLATE 68

CORPS OF ENGINEERS





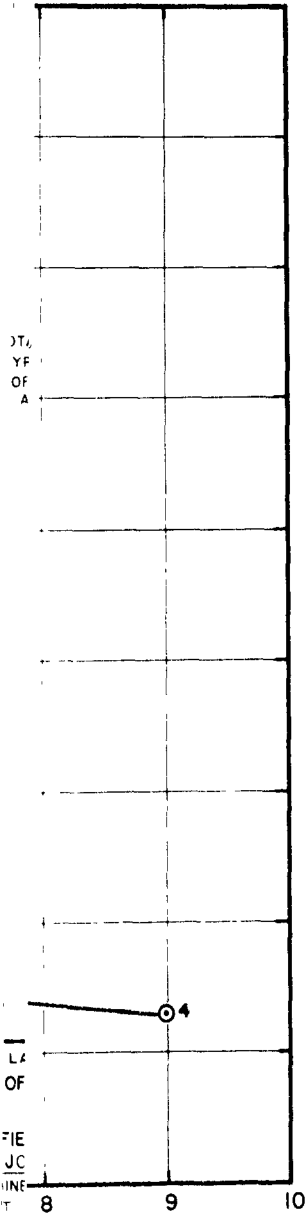
LEGEND

	PROJECT	CONTRACTOR
3	JOE POOL	LANE
4	JOE POOL	SERVIDONE

NOTE THE "WINDOW" OF MOISTURE CONTENT IS THE TOT/ RANGE IN PERCENT ALLOWED FOR A ZONE OR TYF OF FILL. FOR EXAMPLE, AN ALLOWABLE RANGE OF MINUS TWO TO PLUS THREE FROM OPTIMUM IS A FIVE PERCENT WINDOW

JOE POOL L/
PERCENT OF

SPECIFIE
JC
US ARMY ENGINE



LEGEND

	PROJECT	CONTRACTOR	CONTRACT
3	JOE POOL	LANE	IST. CONTRACT
4	JOE POOL	SERVIDONE	COMPLETION CONTRACT

NOTE THE "WINDOW" OF MOISTURE CONTENT IS THE TOTAL RANGE IN PERCENT ALLOWED FOR A ZONE OR TYPE OF FILL FOR EXAMPLE, AN ALLOWABLE RANGE OF MINUS TWO TO PLUS THREE FROM OPTIMUM IS A FIVE PERCENT WINDOW.

JOE POOL LAKE, MOUNTAIN CREEK

PERCENT OF M.C. TESTS FAILED

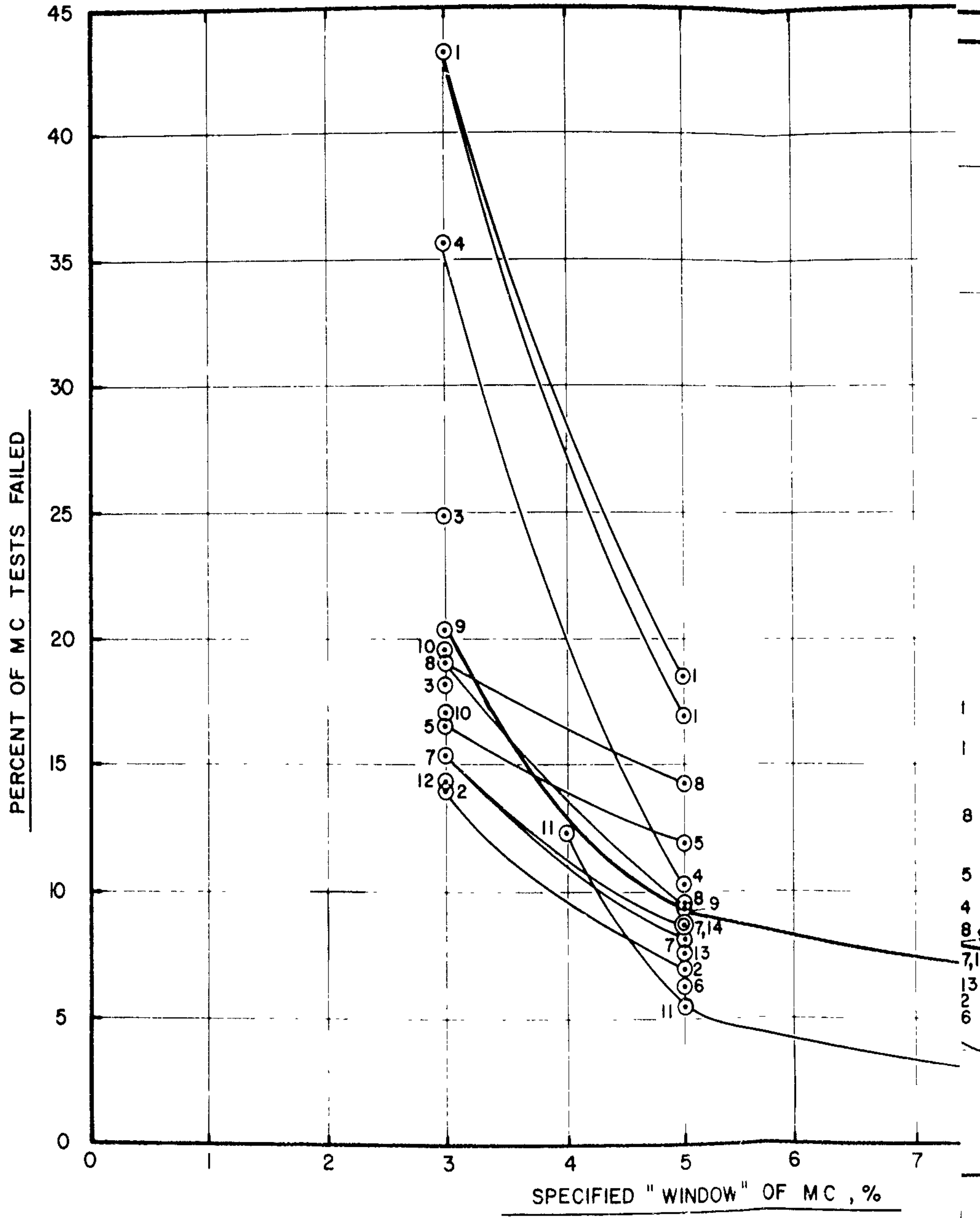
VS

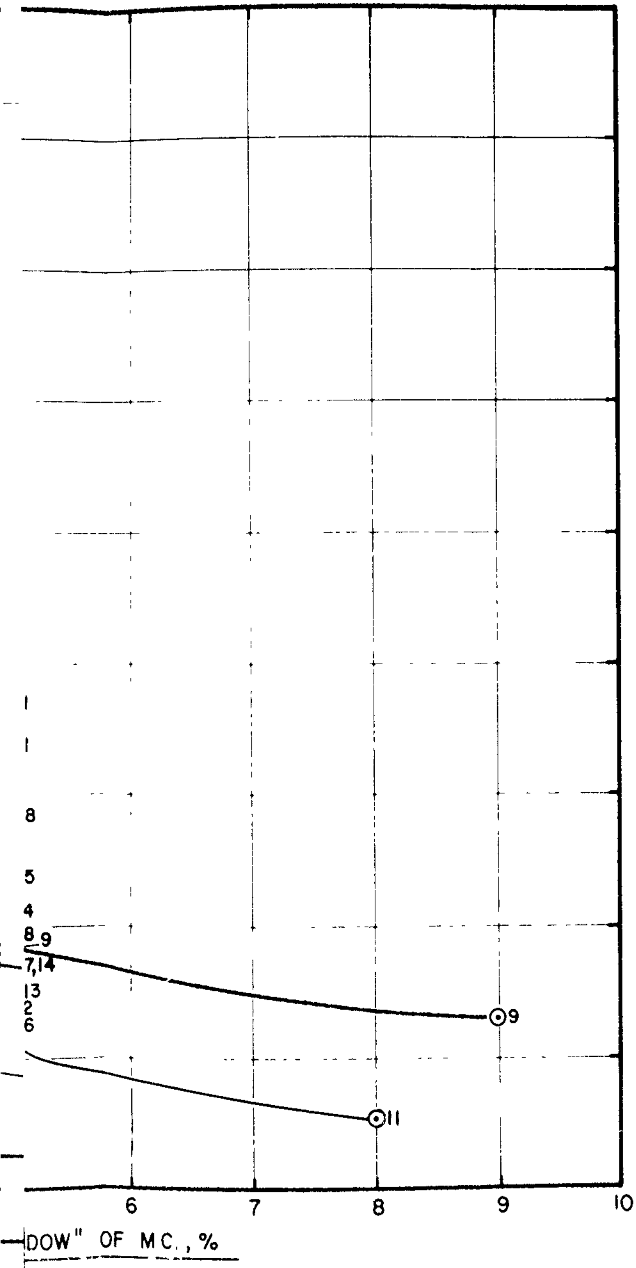
SPECIFIED "WINDOW" OF M.C

JOE POOL LAKE

US ARMY ENGINEER DISTRICT, FT WORTH

PLATE 69


PERCENT OF MC TESTS FAILED
SPECIFIED "WINDOW" OF MC, %
0
5
10
15
20
25
30
35
40
45
1
2
3
4
5
6
7
1
4
3
9
10
8
3
10
5
7
12
2
11
1
1
8
5
4
8
9
7,14
7
13
2
6
11
8
5
4
8
7,1
13
2
6



LEGEND

	PROJECT	CONTRAC
1	AQUILLA	CLEARWATER
2	AQUILLA	HOLLOWAY
3	BARDWELL	MOORMAN & S
4	GEORGETOWN	DAHLSTROM
5	GRANGER	DAHLSTROM
6	GRANGER	HENSEL PHEL
7	GRANGER	ABRAMS
8	JOE POOL	LANE
9	JOE POOL	SERVIDONE
10	PROCTOR	ADAM
11	RAY ROBERTS	PHILLIPS & JO
12	STILLHOUSE HOLLOW	TECON
13	WACO	MOOPMAN & S
14	WACO	CLEMENT BRO

NOTE:

1 ONLY FILLS IN FORT WORTH DISTRICT THAT INC
ARE INCLUDED IN THIS DATA

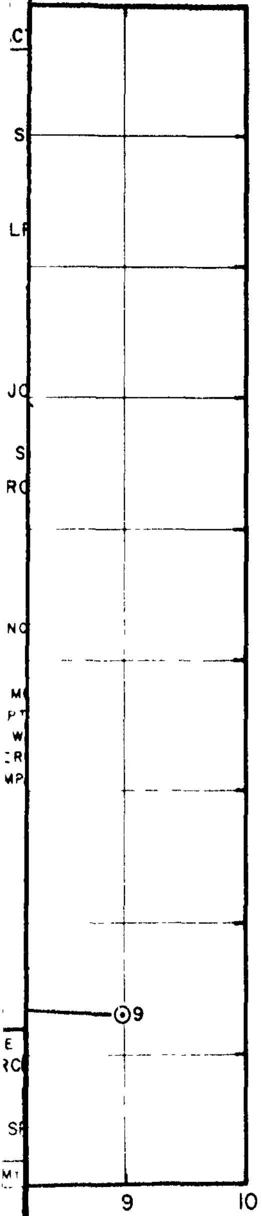
2 THE METHOD USED TO SELECT THE OPTIMUM M
WAS THE LIQUID LIMIT CORRELATION, EXCEPT
AND BARDWELL WHERE VISUAL COMPARISON W
GRANGER (5) AND STILLHOUSE HOLLOW WHER
PARTIALLY PERFORMED USING THE RAPID COMP

JOE
PERC

SP

US ARMY

US ARMY



LEGEND

	PROJECT	CONTRACTOR
1	AQUILLA	CLEARWATER
2	AQUILLA	HOLLOWAY
3	BARDWELL	MOORMAN & SINGLETON
4	GEORGETOWN	DAHLSTROM
5	GRANGER	DAHLSTROM
6	GRANGER	HENSEL PHELPS
7	GRANGER	ABRAMS
8	JOE POOL	LANE
9	JOE POOL	SERVIDONE
10	PROCTOR	ADAM
11	RAY ROBERTS	PHILLIPS & JORDAN
12	STILLHOUSE HOLLOW	TECON
13	WACO	MOORMAN & SINGLETON
14	WACO	CLEMENT BROTHERS

NOTE:

1 ONLY FILLS IN FORT WORTH DISTRICT THAT INCLUDE CH CLAYS ARE INCLUDED IN THIS DATA

2 THE METHOD USED TO SELECT THE OPTIMUM MOISTURE CONTENT WAS THE LIQUID LIMIT CORRELATION, EXCEPT ON WACO AND BARDWELL WHERE VISUAL COMPARISON WAS USED, AND GRANGER (5) AND STILLHOUSE HOLLOW WHERE CONTROL WAS PARTIALLY PERFORMED USING THE RAPID COMPACTION METHOD

JOE POOL LAKE, MOUNTAIN CREEK

PERCENT OF M.C TESTS FAILED

VS

SPECIFIED "WINDOW" OF M.C

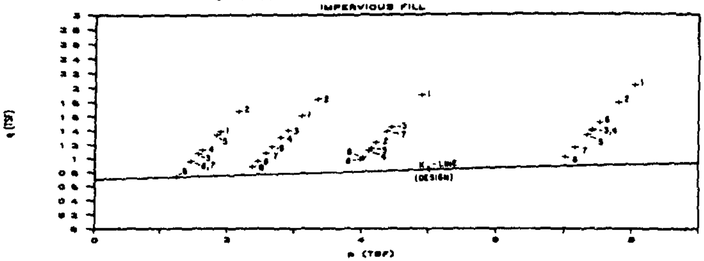
DAMS IN CESWF

US ARMY ENGINEER DISTRICT, FT WORTH

PLATE 70

CORPS OF ENGINEERS

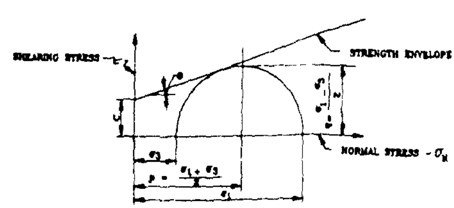
Q TEST—INITIAL CONTRACT
IMPERVIOUS FILL



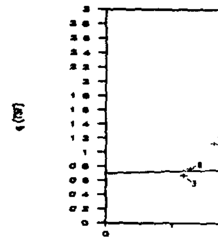
Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	So (%)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
I-1	CH	60	46	29.1	92	94	.849	0.5	3.27	1.89	1.39	1
				27.7	94	92	.822	1.5	4.72	3.11	1.61	1
				27.6	94	92	.821	3.0	6.79	4.90	1.90	1
				29.0	93	95	.837	6.0	10.07	8.04	2.04	1
I-2	CH	66	48	23.6	102	97	.661	0.5	3.84	2.17	1.67	2
				24.6	100	96	.693	1.5	5.18	3.34	1.84	2
				25.9	98	97	.722	3.0	5.46	4.23	1.23	2
				24.7	100	97	.693	6.0	9.60	7.80	1.80	2
I-3	CH	64	45	25.6	98	95	.736	0.5	2.64	1.57	1.07	3
				25.1	98	94	.727	1.5	4.29	2.90	1.40	3
				24.4	100	95	.697	3.0	5.89	4.45	1.45	3
				25.1	99	96	.710	6.0	8.82	7.41	1.41	3
I-4	CH	65	45	26.3	96	94	.758	0.5	2.76	1.63	1.13	4
				25.4	97	93	.741	1.5	4.09	2.80	1.30	4
				26.9	96	95	.767	3.0	5.21	4.11	1.11	4
				25.2	98	93	.736	6.0	8.80	7.40	1.40	4
I-5	CH	63	44	24.5	99	93	.720	0.5	3.17	1.84	1.34	5
				26.1	98	96	.741	1.5	3.84	2.67	1.17	5
				26.7	97	96	.756	3.0	5.30	4.15	1.15	5
				26.2	98	96	.743	6.0	8.68	7.34	1.34	5
I-6	CH	63	46	26.7	96	96	.764	0.5	2.41	1.46	0.96	6
				26.5	97	96	.754	1.5	3.42	2.46	0.96	6
				26.3	98	96	.743	3.0	4.98	3.99	0.99	6
				24.7	99	95	.711	6.0	9.03	7.52	1.52	6
I-250	CH	61	44	23.8	101	97	.661	0.5	2.41	1.46	0.96	7
				23.9	101	97	.661	1.5	3.65	2.58	1.08	7
				23.9	101	97	.666	3.0	5.77	4.39	1.39	7
				23.7	101	97	.661	6.0	8.31	7.16	1.16	7
IU-240	CH	55	40	24.8	97	93	.709	0.5	1.98	1.24	0.74	8
				24.7	98	95	.693	1.5	3.28	2.39	0.89	8
				21.6	101	90	.640	3.0	5.03	4.02	1.02	8
				24.0	99	94	.678	6.0	8.03	7.02	1.02	8

LEGEND

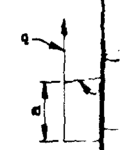
Class	Sample Classification According to the *Unified* Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Water Content
γ_D	Unit Dry Weight
S_o	Saturation Before Shear
e_o	Void Ratio Before Shear
σ_3	Minor Principal Stress
σ_1	Major Principal Stress



DETERMINATION OF "p" AND "q" FROM TRIAXIAL TEST USING MOHR'S DIAGRAM



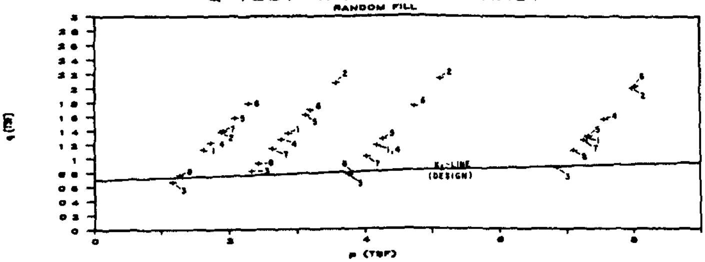
Sample No	Class	LL (%)
R-1	CH	33
R-2	CH	65
R-3	CH	66
R-4	CH	7
R-5	CH	6
R-6	CH	6
R-7	CH	6
R-8	CH	7



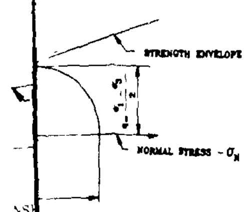
RELATIONS
LIN P

Q TEST—INITIAL CONTRACT

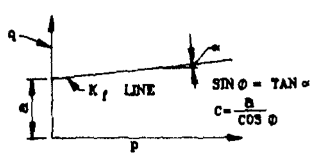
RANDOM FILL



Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	S_e (%)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
R-1	CH	71	51	29.5	94	97	.838	0.5	2.75	1.63	1.13	1
				29.0	94	97	.826	1.5	4.21	2.86	1.36	1
				29.5	94	98	.827	3.0	5.36	4.18	1.18	1
				28.2	95	97	.803	6.0	8.61	7.31	1.31	1
R-2	CH	65	45	23.0	98	86	.715	0.5	3.25	1.88	1.38	2
				23.2	97	85	.734	1.5	5.64	3.57	2.07	2
				23.4	97	86	.730	3.0	7.26	5.13	2.13	2
				23.5	97	87	.721	6.0	9.99	8.00	2.00	2
R-3	CH	66	47	27.9	94	97	.770	0.5	1.84	1.17	0.67	3
				28.1	94	97	.773	1.5	3.15	2.33	0.83	3
				28.7	94	98	.786	3.0	4.54	3.77	0.77	3
				27.6	95	98	.753	6.0	7.73	6.87	0.87	3
R-4	CH	74	53	28.3	94	97	.794	0.5	2.95	1.73	1.23	4
				28.4	94	96	.801	1.5	4.03	2.77	1.27	4
				28.8	95	99	.785	3.0	5.35	4.18	1.18	4
				28.5	95	100	.771	6.0	9.11	7.56	1.56	4
R-5	CH	65	41	25.9	97	95	.742	0.5	3.65	2.08	1.58	5
				25.6	99	97	.720	1.5	4.74	3.12	1.62	5
				26.7	97	96	.753	3.0	5.53	4.27	1.27	5
				26.6	96	95	.761	6.0	8.66	7.33	1.33	5
R-6	CH	65	45	23.7	99	89	.727	0.5	4.07	2.29	1.79	6
				24.7	99	93	.723	1.5	4.88	3.19	1.69	6
				23.5	100	91	.709	3.0	6.48	4.74	1.74	6
				24.2	100	95	.699	6.0	10.06	8.03	2.03	6
R-7	CH	64	45	25.4	98	94	.736	0.5	3.30	1.90	1.40	7
				25.3	98	95	.730	1.5	3.77	2.64	1.14	7
				26.2	98	96	.741	3.0	5.04	4.02	1.02	7
				24.7	99	95	.713	6.0	8.51	7.26	1.26	7
R-8	CH	74	52	28.9	93	96	.824	0.5	2.03	1.27	0.77	8
				29.1	94	98	.810	1.5	3.36	2.43	0.93	8
				29.4	93	98	.822	3.0	4.59	3.80	0.80	8
				28.6	95	99	.789	6.0	8.22	7.11	1.11	8



"p" AND "q" FROM MOHR'S DIAGRAM



RELATIONSHIP OF "c" AND "Φ" TO K_f LINE ON p–q DIAGRAM

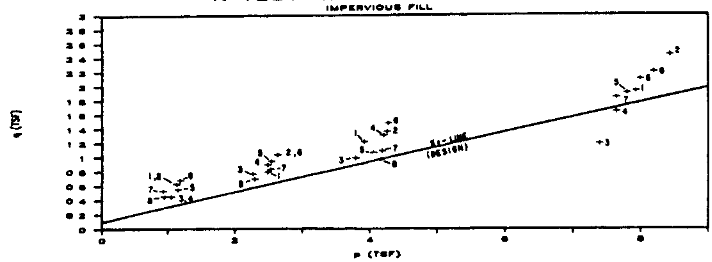
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

RECORD SAMPLE TEST RESULTS
"Q" TRIAXIAL SHEAR TESTS
IMPERVIOUS AND RANDOM FILL
INITIAL CONTRACT

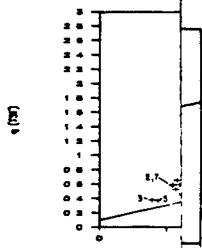
U S ARMY ENGINEER DISTRICT, FT WORTH

CORPS OF ENGINEERS

R TEST—INITIAL CONTRACT
IMPERVIOUS FILL



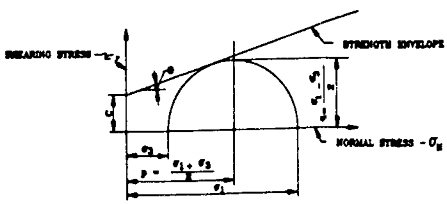
Sample No	Class	LL (%)	PI (%)	Wc (%)	γ_D (PCF)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
I-1	CH	68	46	32.0	91	.879	0.5	1.75	1.13	0.63	1
				29.2	95	.801	1 7	3.30	2.50	0 80	1
				25.8	100	.709	2.7	5.14	3.92	1.22	1
				22 9	106	.628	6.0	9.85	7.93	1.93	1
I-2	CH	66	48	27.6	97	.751	0.5	1 75	1 13	0.63	2
				25.8	100	.701	1.6	3.68	2.64	1.04	2
				25.6	100	.695	2.9	5.61	4.26	1.36	2
				23.3	104	.634	6.0	10.87	8.44	2.44	2
I-3	CH	64	45	30.8	93	.842	0.6	1.49	1.05	0.45	3
				30.0	94	.819	1.5	3.03	2.27	0.77	3
				28.9	95	.789	2 8	4.77	3 79	0 99	3
				28.0	97	.764	6.2	8.58	7.39	1 19	3
I-4	CH	65	45	29.8	94	.814	0.6	1.50	1.05	0.45	4
				27 7	97	.756	1.6	3.39	2 50	0.90	4
				26 5	99	.724	2 9	5 51	4 21	1.31	4
				24.9	101	.680	6.0	9.27	7 64	1.64	4
I-5	CH	63	44	28.6	96	.782	0.6	1.70	1.15	0.55	5
				27.0	98	.741	1.6	3.49	2 55	0 95	5
				27 2	98	.745	3.0	5 11	4 06	1 06	5
				25.5	101	.699	5.9	9.69	7.80	1 90	5
I-6	CH	63	46	28.0	97	766	0.5	1.86	1.18	0.68	6
				26.9	98	.737	1.6	3.67	2.64	1.04	6
				25.3	101	.692	2.8	5.75	4.28	1.48	6
				23 6	104	.645	5.9	10.09	8.00	2 10	6
I-250	CH	61	44	26.5	98	.714	0.4	1.45	0 93	0.53	7
				26.0	99	702	1.7	3 38	2 54	0.84	7
				24.7	101	.666	3 1	5.28	4.19	1 09	7
				23.3	103	.630	5.8	9.47	7.64	1.84	7
IU-240	CH	55	40	25.8	99	.688	0 5	1.40	0 95	0.45	8
				23.0	103	.614	1.6	2.99	2.30	0 70	8
				22 9	104	.610	3 2	5 13	4 17	0 97	8
				19.6	108	.523	6.0	10.39	8.20	2.20	8



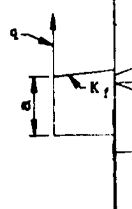
Sample No	Class
R-1	CH
R-2	CH
R-3	CH
R-4	CH
R-5	CH
R-6	CH
R-7	CH
R-8	CH

LEGEND

Class	Sample Classification According to the Unified Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Water Content
γ_D	Unit Dry Weight
S_o	Saturation Before Shear
e_o	Void Ratio Before Shear
σ_3	Minor Principal Stress
σ_1	Major Principal Stress



DETERMINATION OF "p" AND "q" FROM TRIAXIAL TEST USING MOHR'S DIAGRAM

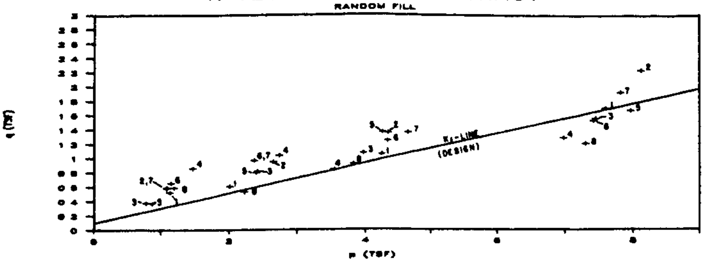


RELA

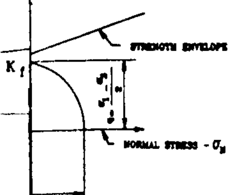
MO

US ARMY

R TEST—INITIAL CONTRACT
RANDOM FILL

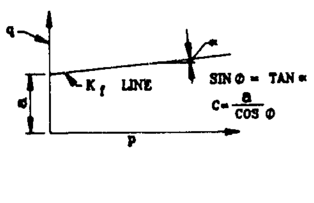


Sample No	Class	LL (%)	PI (%)	w_c (%)	γ_d (PCF)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
R-1	CH	71	51	30.8	93	.852	0 6	1.66	1 13	0.53	1
				29.6	95	.819	1.4	2.62	2.01	0 61	1
				28.8	96	.796	3.2	5.29	4.25	1.05	1
				25.7	101	.711	5.9	9.29	7.60	1.70	1
R-2	CH	65	45	29.7	94	.802	0.5	1.68	1 09	0 59	2
				28 0	96	756	1.7	3 60	2.65	0.95	2
				26 5	98	714	3.0	5.70	4 35	1 35	2
				24.7	101	.667	5 9	10.35	8.13	2.23	2
R-3	CH	66	47	30.8	92	.828	0.4	1.16	0.78	0.38	3
				29.9	93	804	1.6	3.23	2.42	0 82	3
				28.2	96	.757	2.9	5.04	3.97	1 07	3
				26.6	98	.715	5.9	9.02	7.46	1.56	3
R-4	CH	74	53	30.3	93	.823	0.6	2.31	1.46	0 86	4
				29.4	94	.799	1.7	3.77	2.74	1.04	4
				27.9	97	.759	2.7	4.38	3 54	0.84	4
				27.3	97	743	5 7	8.27	6 99	1.29	4
R-5	CH	65	46	27.5	97	.750	0 5	1.23	0 87	0.37	5
				28.5	96	779	1 6	3.20	2 40	0.80	5
				25.7	100	.702	2.9	5 61	4.26	1 36	5
				25.3	101	.691	6 3	9.64	7.97	1.67	5
R-6	CH	65	45	28.5	96	.783	0.5	1 79	1 15	0 65	6
				27.1	98	746	1.4	3.33	2.37	0.97	6
				25.5	101	.702	3 1	5.57	4.34	1.24	6
				25.6	101	.704	5.9	8.96	7 43	1.53	6
R-7	CH	64	45	28.8	96	.788	0 5	1 66	1.08	0 58	7
				27.7	97	.758	1.4	3 34	2 37	0 97	7
				26.5	99	.729	3 3	6.01	4.66	1 36	7
				25 2	101	.689	5.9	9 73	7.82	1.92	7
R-8	CH	74	52	31.7	91	.869	0.6	1.77	1 19	0.59	8
				30 8	93	.843	1.7	2 75	2 23	0.53	8
				29 0	95	794	2.9	4 74	3 82	0 92	8
				26.7	99	730	6 1	8 51	7 31	1 21	8



LAI

" AND "q" FROM
MOHR S DIAGRAM



RELATIONSHIP OF "c" AND "Φ" TO K_f
LINE ON p–q DIAGRAM

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

RECORD SAMPLE TEST RESULTS
"R" TRIAXIAL SHEAR TESTS
IMPERVIOUS AND RANDOM FILL
INITIAL CONTRACT

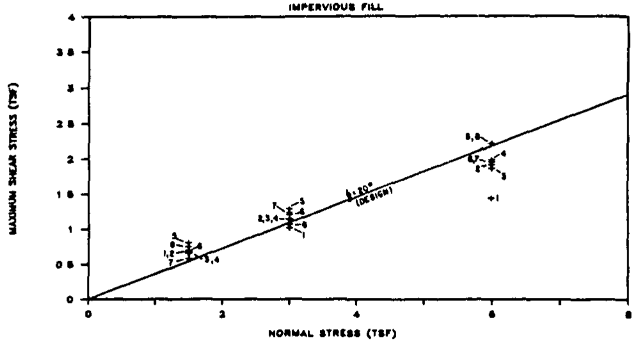
US ARMY ENGINEER DISTRICT, FT WORTH

PLATE 72

CORPS OF ENGINEERS

S TEST—INITIAL CONTRACT

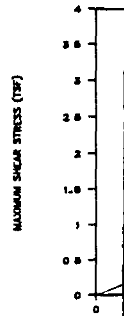
IMPERVIOUS FILL



Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_o	Normal Stress (TSF)	Max. Shear Stress (TSF)	PLOT SYMBOL
1-1	CH	68	46	25.7	100	.713	1 5	0.69	1
				26 0	100	.711	3.0	1.02	1
				25.9	100	.715	6.0	1.44	1
1-2	CH	66	48	24 6	101	668	1.5	0.69	2
				24.3	102	.663	3.0	1.14	2
				24.8	101	.674	6.0	1.92	2
1-3	CH	64	45	25 2	101	.682	1.5	0 66	3
				25 3	100	.687	3.0	1.15	3
				24.8	101	.673	6.0	1.87	3
1-4	CH	65	45	23 6	99	.721	1 5	0.66	4
				23.9	98	.739	3 0	1.14	4
				23.4	100	.706	6.0	1 99	4
1-5	CH	63	44	24.0	100	.702	1.5	0 81	5
				23 3	100	.704	3 0	1.29	5
				23.5	101	.692	6.0	2.27	5
1-6	CH	63	46	24 0	102	673	1.5	0 70	6
				24.0	101	.683	3.0	1 21	6
				23.9	102	.671	6.0	1.96	6
1-250	CH	61	44	25 8	99	686	1.5	0 58	7
				25.6	99	.691	3.0	1.24	7
				25.4	100	.679	6.0	1.96	7
1U-240	CH	55	40	23.5	101	.643	1 5	0.75	8
				26.0	99	.678	3.0	1.07	8
				23 7	101	.642	6.0	2.27	8

LEGEND

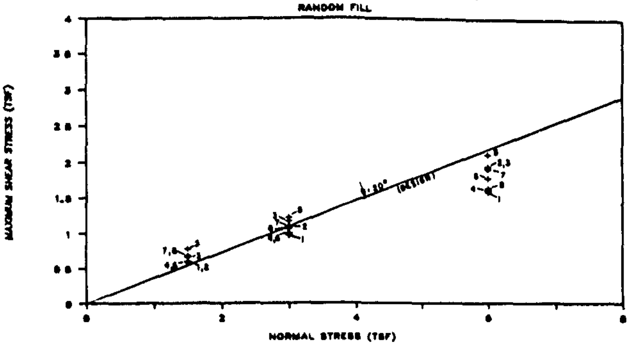
Class	Sample Classification According to the Unified Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Wate content
γ_D	Unit Dry Weight
e_o	Void Ratio before Shear



Sample No
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8

S TEST—INITIAL CONTRACT

RANDOM FILL



Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_d (PCF)	e_o	Normal Stress (TSF)	Max. Shear Stress (TSF)	PLOT SYMBOL
R-1	CH	71	51	28.1	101	.767	1.5	0.60	1
				28.0	102	.783	3.0	0.98	1
				28.6	101	.777	6.0	1.60	1
R-2	CH	65	45	25.4	101	.663	1.5	0.60	2
				25.9	100	.677	3.0	1.08	2
				25.4	101	.663	6.0	1.92	2
R-3	CH	66	47	26.6	98	.704	1.5	0.66	3
				26.4	97	.716	3.0	1.17	3
				25.1	98	.683	6.0	1.96	3
R-4	CH	74	53	27.8	96	.759	1.5	0.50	4
				28.2	97	.744	3.0	1.00	4
				27.3	97	.743	6.0	1.63	4
R-5	CH	65	46	24.8	95	.701	1.5	0.70	5
				25.7	97	.754	3.0	1.22	5
				26.8	94	.798	6.0	2.12	5
R-6	CH	65	45	23.4	103	.651	1.5	0.50	6
				24.0	102	.674	3.0	1.00	6
				22.7	104	.646	6.0	1.79	6
R-7	CH	64	45	25.7	98	.713	1.5	0.60	7
				26.5	98	.734	3.0	1.10	7
				26.0	98	.714	6.0	1.92	7
R-8	CH	74	52	27.9	95	.790	1.5	0.60	8
				28.6	94	.806	3.0	1.07	8
				27.6	95	.782	6.0	1.66	8

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

RECORD SAMPLE TEST RESULTS

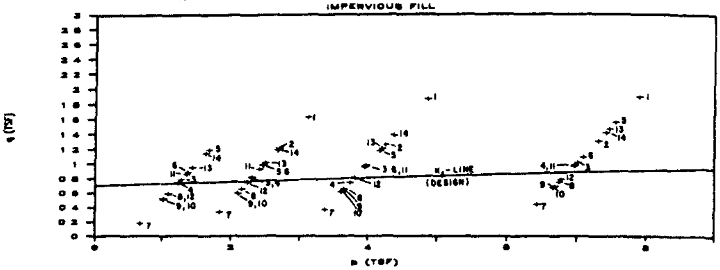
"S" DIRECT SHEAR TESTS
IMPERVIOUS AND RANDOM FILL
INITIAL CONTRACT

US ARMY ENGINEER DISTRICT, FT WORTH

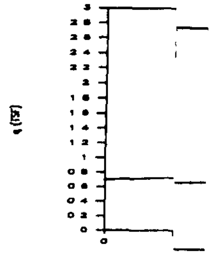
CORPS OF ENGINEERS

Q TEST—COMPLETION CONTRACT

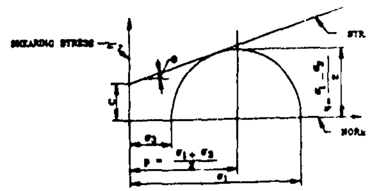
IMPERVIOUS FILL



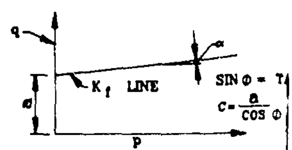
Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	So (%)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
PR-1	CH	74	54	25.2	100	95	.74	1 5	4.75	3.13	1 63	1
				25.8	97	88	.8	3.0	6.74	4.87	1.87	1
				27.	99	98	.77	6.0	9.79	7.90	1 90	1
PR-3	CH	69	50	25	100	94	.75	1 5	3.91	2.71	1 21	2
				25 1	102	97	.72	3 0	5.52	4 26	1.26	2
				25 6	102	99	.73	6 0	8.62	7.31	1.31	2
PR-6	CH	68	49	29 4	92	95	849	0 5	2 05	1.28	0 78	3
				28 7	93	94	836	1.5	3.14	2.32	0.82	3
				29 4	92	95	.841	3 0	4.94	3.97	0.97	3
				28 8	93	94	832	6 0	8 03	7 02	1.02	3
PR-7	CH	65	46	27 4	95	95	.784	0 5	1 98	1 24	0.74	4
				28.6	93	95	.810	1.5	3 11	2 31	0.81	4
				27.7	95	96	.779	3 0	4.47	3.74	0.74	4
				27.7	95	96	.782	6 0	7.95	6 98	0.98	4
PR-8	CH	70	50	26 4	95	93	.770	0 5	2.87	1.69	1 19	5
				28.9	93	96	817	1.5	3 45	2.48	0 98	5
				28 0	94	96	787	3.0	5.36	4.18	1.18	5
				26 5	95	93	769	6.0	9 11	7.56	1 56	5
PR-10	CH	56	38	25.3	98	93	.749	0.5	2.26	1 38	0 88	6
				24.7	98	92	.741	1.5	3 48	2.49	0.99	6
				25 1	99	93	.739	3 0	4.96	3.98	0 98	6
				25.0	98	92	.749	6.0	8.17	7 09	1 09	6
PR-12	CL	49	34	33 4	85	93	.961	0 5	0 85	0.68	0.18	7
				29 3	91	93	.843	1 5	2.17	1.84	0.34	7
				28 8	92	94	.823	3 0	3.74	3 37	0.37	7
				26 1	93	89	789	6.0	6.87	6 44	0.44	7
PR 13	CH	68	47	27 9	94	95	.797	0 5	1.68	1.09	0.59	8
				26 9	95	94	780	1 5	2 82	2 16	0.66	8
				27 5	94	93	802	3.0	4.30	3.65	0.65	8
				26.4	95	92	.773	6 0	7.50	6 75	0.75	8
PR 14	CH	62	43	28.0	94	94	.806	0.5	1.52	1 01	0.51	9
				28.3	93	95	.807	1.5	2.70	2.10	0 60	9
				27.3	94	94	.791	3.0	4 26	3 63	0 63	9
				27 9	94	95	.797	6.0	7 37	6 69	0.69	9
PR-16	CH	54	40	24.9	98	94	714	0 5	1.53	1.02	0.52	10
				24.2	99	94	.693	1 5	2 70	2 10	0.60	10
				22.9	101	93	.663	3 0	4.21	3.61	0 61	10
				22 2	101	92	652	6 0	7 34	6.67	0.67	10
PR 17	CH	63	47	24.3	101	97	682	0 5	2.21	1 36	0 86	11
				23.7	101	96	.672	1.5	3.35	2.43	0 93	11
				23.9	101	96	673	3 0	4 91	3 96	0.96	11
				24.2	101	97	.680	6.0	7.93	6 97	0 97	11
PR 18	CH	39	26	21.9	103	95	.618	0.5	1 67	1 09	0 59	12
				21 4	106	100	.574	1.5	2.99	2 25	0 75	12
				21.3	105	96	.591	3 0	4 61	3 81	0 81	12
				22.1	104	98	.600	6.0	7.56	6 78	0 78	12
PR 23	CH	57	39	24 7	100	98	682	0 5	2.39	1.45	0.95	13
				23 5	102	98	.651	1 5	3 54	2.52	1 02	13
				24 8	101	99	.678	3 0	5.41	4 21	1 21	13
				23.7	102	99	.650	6 0	8 93	7.47	1 47	13
PR-24	CH	66	45	25 2	99	98	.683	0.5	2 77	1.64	1 14	14
				25 3	98	98	692	1 5	3 87	2 69	1 19	14
				24.7	100	98	671	3 0	5.77	4 39	1 39	14
				25 0	100	100	671	6 0	8 84	7 42	1 42	14



Sample No	Class
PR-2	CH
PR-4	CH
PR-5	CH
PR-9	CH
PR-11	CH
PR-15	CH
PR 22	CH



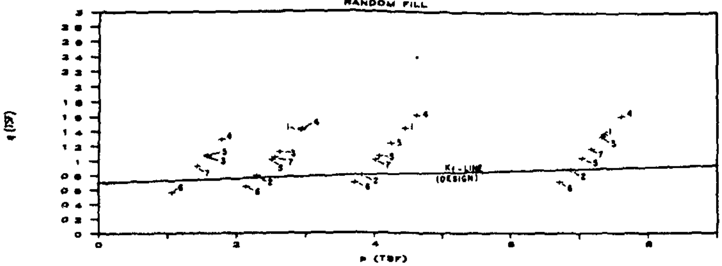
DETERMINATION OF "p" AND "q" FRC
TRIAXIAL TEST USING MOHR S DIAGR/



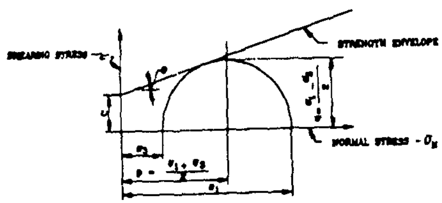
RELATIONSHIP OF "c" AND "Φ" TO K
LINE ON p-q DIAGRAM

US ARMY

Q TEST—COMPLETION CONTRACT



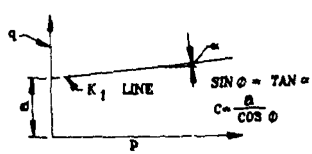
Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	So (%)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
PR-2	CH	72	52	24.8	100	95	.73	1.5	4.33	2.92	1.42	1
				24.6	101	95	.73	3 0	5.88	4.44	1.44	1
				24.7	102	98	.71	6.0	8.72	7.36	1.36	1
PR-4	CH	68	50	27.8	97	99	.78	1.5	3.07	2.29	0.79	2
				27	99	100	.75	3.0	4.59	3.80	0 80	2
				26.1	102	100	.69	6 0	7.76	6 88	0.88	2
PR-5	CH	66	42	28.9	92	94	835	0.5	2.64	1.57	1.07	3
				29.2	92	94	.838	1 5	3.74	2.62	1.12	3
				29 2	92	94	.838	3 0	5 47	4.24	1 24	3
				29.4	92	95	.837	6.0	8 65	7.33	1.33	3
PR-9	CH	55	36	23.1	98	87	.728	0.5	3.08	1.79	1.29	4
				22 5	100	87	.708	1.5	4 38	2.94	1.44	4
				23.5	99	89	.718	3.0	6 23	4.62	1.62	4
				23.3	99	89	.711	6.0	9.21	7.61	1.61	4
PR-11	CH	61	41	23.6	98	89	.713	0.5	2 65	1.58	1.08	5
				25.7	97	95	.732	1.5	3.52	2.51	1.01	5
				25.0	98	95	.711	3.0	5.12	4.06	1.06	5
				25.2	98	96	.710	6.0	8.07	7.04	1 04	5
PR-15	CH	50	36	23.2	99	91	.686	0.5	1.63	1.07	0.57	6
				23.6	99	92	.689	1.5	2.77	2.14	0.64	6
				22 6	101	91	.663	3.0	4.37	3.69	0.69	6
				22.8	101	92	.667	6.0	7 42	6.71	0.71	6
PR 22	CH	61	45	22 2	103	97	615	0.5	2 35	1.43	0.93	7
				21 6	105	98	.590	1.5	3.60	2.55	1.05	7
				21 7	105	97	.598	3.0	5.01	4.01	1.01	7
				21.3	104	95	.599	6.0	8.33	7.17	1 17	7



DETERMINATION OF "p" AND "q" FROM TRIAXIAL TEST USING MOHR S DIAGRAM

LEGEND

Class	Sample Classification According to the Unified Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Water Content
γ_D	Unit Dry Weight
S_o	Saturation Before Shear
e_o	Void Ratio Before Shear
σ_3	Minor Principal Stress
σ_1	Major Principal Stress



RELATIONSHIP OF "c" AND "Φ" TO K_f LINE ON p-q DIAGRAM

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

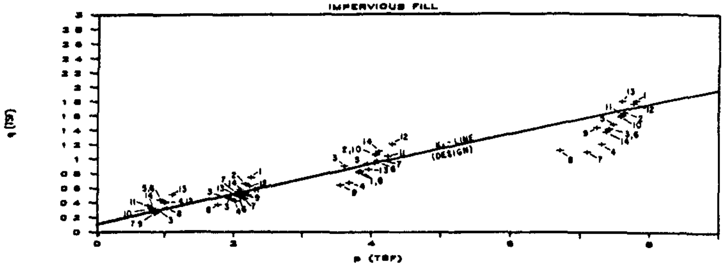
RECORD SAMPLE TEST RESULTS
"Q" TRIAXIAL SHEAR TESTS
IMPERVIOUS AND RANDOM FILL
COMPLETION CONTRACT

US ARMY ENGINEER DISTRICT, FT WORTH

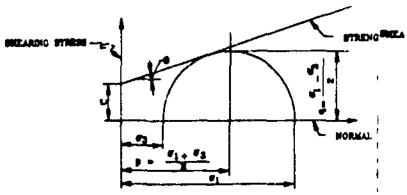
PLATE 74

R TEST—COMPLETION CONTRACT

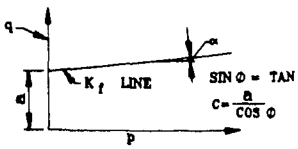
IMPERVIOUS FILL



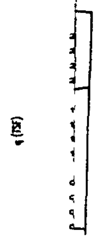
Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
PR-1	CH	74	54	28 2	99	.76	1 5	2.99	2.25	0.75	1
				28.8	97	.8	3 0	4 68	3 84	0.84	1
				26 4	104	.68	6.0	9.61	7.81	1.81	1
PR-3	CH	69	50	27.7	101	.73	1 5	2 81	2 16	0.66	2
				25 3	106	66	3.0	5.14	4 07	1 07	2
				24 8	106	65	6 0	9.27	7 64	1.64	2
PR-6	CH	68	49	32 7	90	895	0 6	1 20	0 90	0 30	3
				27 1	98	.742	1 5	2 41	1.96	0.46	3
				24 1	103	.659	3 1	4.82	3.96	0.86	3
				25 8	100	708	6 0	8.81	7 41	1.41	3
PR-7	CH	65	46	29 9	94	813	0 6	1.40	1 00	0 40	4
				29 0	95	789	1 6	2.46	2 03	0 43	4
				27 2	98	.738	3 0	4.35	3.68	0 68	4
				26 6	99	.723	6 1	8 51	7.31	1 21	4
PR-8	CH	70	50	30.8	92	.833	0 5	1 38	0 94	0 44	5
				30 5	93	826	1 4	2.37	1.89	0 49	5
				29 5	94	.798	3 0	4 87	3 94	0.94	5
				27.5	97	.744	6 0	8.95	7.48	1 48	5
PR-10	CH	56	38	27 7	98	.764	0 5	1 37	0 94	0 44	6
				26.7	99	.736	1 5	2 62	2 06	0 56	6
				26 0	100	718	3 1	4 99	4 05	0.95	6
				23 1	105	636	6 0	8 84	7 42	1.42	6
PR-12	CL	49	34	26 5	98	713	0 6	1 14	0.87	0 27	7
				24 7	101	665	1 6	2 58	2 09	0 49	7
				23 5	103	632	3 1	5 06	4 08	0 98	7
				22 9	104	616	6 0	8 19	7 10	1 10	7
PR-13	CH	68	47	29 6	94	.804	0.7	1.36	1.03	0.33	8
				29 5	94	803	1 4	2 16	1.78	0 38	8
				26 6	99	723	3 0	4 64	3 82	0.82	8
				[illegible]	101	674	5 6	7 84	6 72	1 12	8
PR-14	CH	62	43	29 9	[illegible]	.813	0 6	1 12	0 86	0 26	9
				28 6	95	.778	1 7	2 61	2 16	0.46	9
				28.2	96	767	2.9	4 19	3.55	0.65	9
				25.2	101	.684	5.8	8.68	7.24	1.44	9
PR-16	CH	54	40	24.6	101	.663	0 5	1 11	0 81	0 31	10
				22.8	104	.614	1 7	2 72	2 21	0.51	10
				20.0	109	.540	3 0	5 11	4 06	1 06	10
				19.2	111	.518	6.0	9.18	7.59	1 59	10
PR-17	CH	63	47	26 6	99	.725	0.4	1.12	0 76	0 36	11
				25.2	101	687	1 6	2 68	2 14	0.54	11
				23 9	103	.651	3 2	5.28	4 24	1.04	11
				21 7	107	.591	6 0	9 21	7.61	1 61	11
PR-18	CL	39	26	22 0	105	.590	0 6	1 41	1 01	0.41	12
				21.1	107	564	1 6	2 85	2 23	0 63	12
				19.8	109	.530	3 1	5 52	4.31	1 21	12
				19 2	110	.515	6 0	9 53	7.77	1.77	12
PR-23	CH	57	39	26.5	99	.721	0 6	1 62	1.11	0.51	13
				25 3	101	688	1 5	2.53	2.02	0.52	13
				25 0	101	.681	2 7	4 51	3 61	0 91	13
				23 4	104	635	5 8	9 39	7 60	1 80	13
PR-24	CH	66	45	30 7	92	.822	0 5	1 16	0 83	0 33	14
				29 1	94	.780	1 5	2 68	2.09	0.59	14
				25 7	99	.688	3 0	5 22	4 11	1 11	14
				31 7	90	850	6.0	8.76	7.38	1 38	14

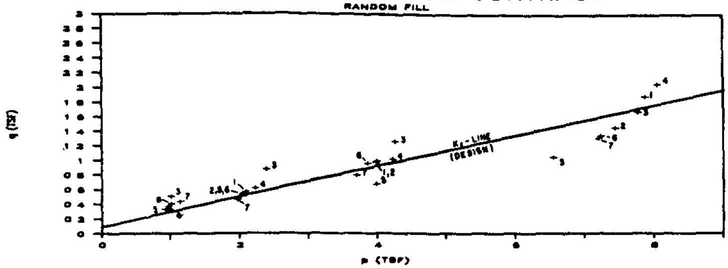


DETERMINATION OF "p" AND "q" FROM TRIAXIAL TEST USING MOHRS DIAGRAM

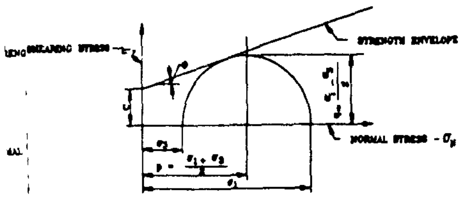


RELATIONSHIP OF "c" AND "Φ" TO K_f LINE ON p–q DIAGRAM





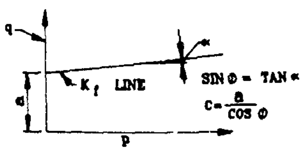
Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
PR-2	CH	72	52	26.2	103	.69	1.5	2.66	2.08	0.58	1
				25.2	107	.64	3 0	4.97	3.99	0.99	1
				23 8	109	.6	6.0	9.75	7.88	1.88	1
PR-4	CH	68	50	29.3	100	.74	1.5	2.60	2.05	0.55	2
				29 1	103	69	3 0	4.95	3.98	0.98	2
				27.2	105	.64	6.0	8.89	7.45	1.45	2
PR-5	CH	66	42	31 9	91	.868	0 5	1.51	1.01	0 51	3
				30.3	93	.825	1.5	3.25	2.38	0.88	3
				28.9	95	.786	3.0	5.51	4.26	1.26	3
				28.5	96	.775	6.1	9.43	7.77	1.67	3
PR-9	CH	55	36	27.5	98	.752	0.6	1 34	0.97	0.37	4
				25.7	100	.704	1.6	2.84	2.22	0.62	4
				25.4	101	.696	3.2	5.23	4.22	1.02	4
				22.9	105	626	6.0	10.10	8.05	2.05	4
PR-11	CH	61	41	26.7	98	.722	0.6	1.25	0.93	0.33	5
				25.6	100	.692	1.5	2 58	2.04	0.54	5
				25.5	100	691	3.3	4 65	3.98	0 68	5
				24.7	101	.670	5.5	7.60	6.55	1.05	5
PR-15	CH	50	36	24.7	101	.665	0.6	1.42	1 01	0.41	6
				23.4	103	.632	1.5	2.58	2.04	0.54	6
				22.0	106	.592	2.9	4 82	3 86	0.96	6
				21.1	107	.569	5.9	8.57	7 24	1.34	6
PR-22	CH	61	45	24.4	101	.656	0 7	1 57	1.14	0 44	7
				24.1	102	649	1.5	2.44	1 97	0.47	7
				23.4	103	629	2.9	4.49	3.70	0 80	7
				22.9	104	.615	5 9	8.52	7.21	1 31	7



DETERMINATION OF "p" AND "q" FROM TRIAXIAL TEST USING MOHR S DIAGRAM

LEGEND

Class	Sample Classification According to the Unified Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Water Content
γ_D	Unit Dry Weight
S_o	Saturation Before Shear
e_o	Void Ratio Before Shear
σ_3	Minor Principal Stress
σ_1	Major Principal Stress



RELATIONSHIP OF "c" AND "ϕ" TO K_f LINE ON p-q DIAGRAM

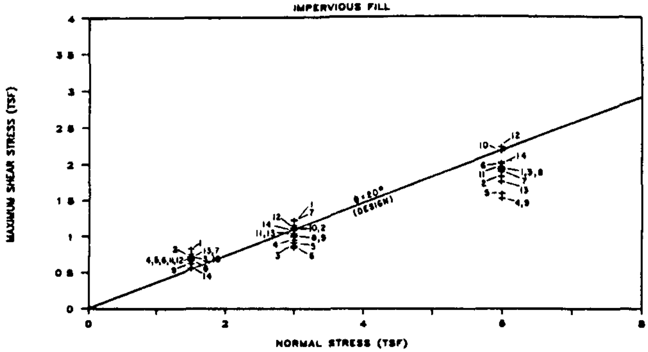
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

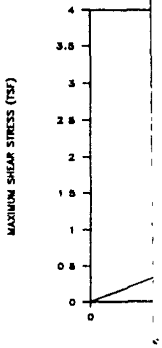
RECORD SAMPLE TEST RESULTS
"R" TRIAXIAL SHEAR TESTS IMPERVIOUS AND RANDOM FILL COMPLETION CONTRACT

U S ARMY ENGINEER DISTRICT, FT WORTH

S TEST—COMPLETION CONTRACT

IMPERVIOUS FILL





Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_0	Normal Stress (TSF)	Max Shear Stress (TSF)	PLOT SYMBOL
PR-1	CH	74	54	26.2	98	.75	1.5	0 83	1
				25.2	99	.73	3.0	1 23	1
				26.1	98	.72	6.0	1.94	1
PR-3	CH	69	50	25.7	102	.72	1 5	0.75	2
				25.7	100	.72	3.0	1 12	2
				25.4	101	.66	6.0	1.82	2
PR-6	CH	68	49	27 5	97	.761	1 5	0.71	3
				26 0	100	.706	3.0	0.87	3
				25.1	99	717	6 0	1.93	3
PR-7	CH	65	46	27 5	97	.747	1 5	0 68	4
				27 9	96	758	3 0	0 95	4
				28.4	95	.772	6 0	1 52	4
PR-8	CH	70	50	27 1	97	.728	1 5	0 68	5
				26 7	98	722	3 0	0 91	5
				26 9	97	729	6 0	1.59	5
PR-10	CH	56	38	24.6	102	.688	1 5	0 68	6
				25.1	102	679	3 0	0 85	6
				25 0	102	.646	6 0	2 00	6
PR-12	CL	49	34	26 0	98	.705	1 5	0 72	7
				25 8	99	689	3 0	1 22	7
				24.0	100	674	6.0	1.89	7
PR-13	CH	68	47	27 5	97	.743	1.5	0.66	8
				27 9	96	753	3 0	1 01	8
				27.4	97	738	6 0	1 92	8
PR-14	CH	62	43	27 5	97	741	1 5	0 62	9
				27 3	97	737	3 0	1 00	9
				27.0	98	.732	6 0	1 52	9
PR-16	CH	54	40	22.1	105	603	1 5	0 70	10
				23 6	100	670	3 0	1 11	10
				21 4	107	574	6 0	2.18	10
PR-17	CH	63	47	23.2	103	646	1 5	0.68	11
				24.4	100	.688	3.0	1.04	11
				24.0	103	652	6.0	1 96	11
PR-18	CL	39	26	22.7	103	.623	1 5	0 68	12
				22 4	103	.609	3 0	1.15	12
				20.6	106	.568	6 0	2 23	12
PR-23	CH	56	39	24 8	100	698	1.5	0 72	13
				25.5	99	699	3.0	1.04	13
				25.5	100	697	6.0	1.75	13
PR-24	CH	66	45	25.4	98	.703	1 5	0.56	14
				24.2	99	683	3.0	1.09	14
				24.1	99	.683	6 0	2.02	14

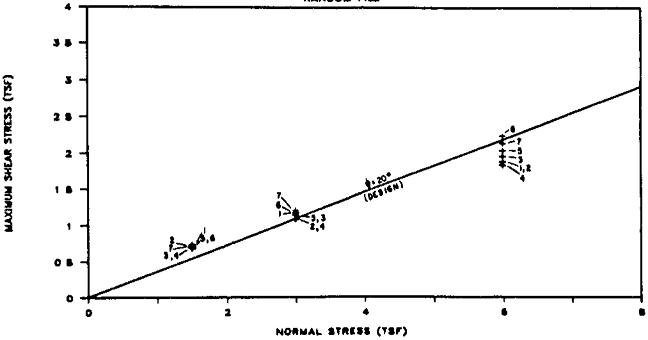
Sample No	Cla
PR-2	C
PR-4	Ch
PR-5	CH
PR-9	CH
PR-11	
PR-15	CH
PR-22	Ch

LEGEND

Class	Sample Classification According to Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Water Content
γ_D	Unit Dry Weight
e_0	Void Ratio before Shear

S TEST—COMPLETION CONTRACT

RANDOM FILL



Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_o	Normal Stress (TSF)	Max. Shear Stress (TSF)	PLOT SYMBOL
PR-2	CH	72	52	22.2	105	66	1 5	0.75	1
				22.4	105	.67	3 0	1 17	1
				23.0	105	66	6 0	1.88	1
PR-4	CH	68	50	27.1	100	73	1 5	0.72	2
				27.2	101	71	3 0	1 09	2
				28.0	96	8	6.0	1 89	2
PR-5	CH	66	42	30.3	93	.824	1.5	0.69	3
				30.3	93	824	3.0	1 14	3
				29 0	94	789	6 0	1.96	3
PR-9	CH	55	36	24.0	101	680	1 5	0 69	4
				24.1	101	692	3 0	1.09	4
				23 6	102	.661	6 0	1.84	4
PR-11	CH	61	41	22.3	105	608	1 5	0.74	5
				23 0	102	.644	3.0	1 14	5
				22 0	105	.599	6 0	2.04	5
PR-15	CH	50	36	21.4	107	574	1 5	0 73	6
				21.2	107	567	3.0	1 18	6
				20.3	108	550	6 0	2.24	6
PR-22	CH	61	45	22.2	104	608	1.5	0 70	7
				21 2	105	588	3 0	1 21	7
				21.5	105	586	6 0	2.14	7

LEGEND

Class	Sample Classification According to the Unified Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Water Content
γ_D	Unit Dry Weight
e_o	Void Ratio before Shear

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

RECORD SAMPLE TEST RESULTS
"S" DIRECT SHEAR TESTS
IMPERVIOUS AND RANDOM FILL
COMPLETION CONTRACT

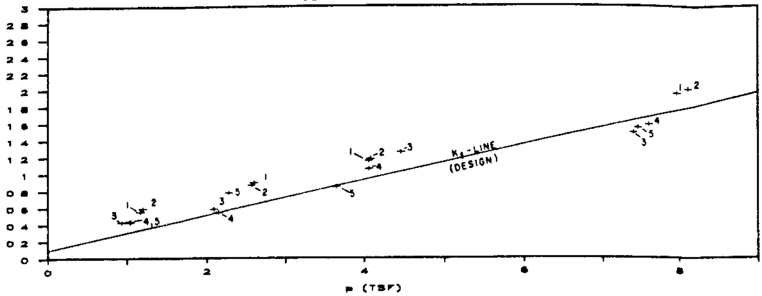
U S ARMY ENGINEER DISTRICT, FT WORTH

PLATE 76

CORPS OF ENGINEERS

R TEST—INITIAL & COMPLETION CONTRACT

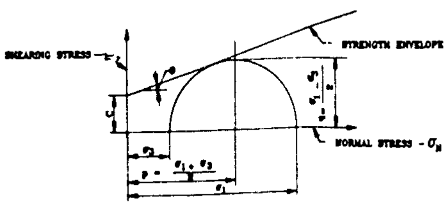
SELECT IMPERVIOUS



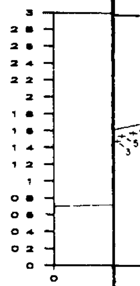
Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_0	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
SI-1	CH	57	41	24.9	101	678	0 6	1 72	1 16	0 56	1
				23 4	104	.635	1 7	3 49	2 60	0 90	1
				22.2	106	603	2 9	5.22	4 06	1 16	1
				20 3	109	551	6 0	9 91	7 96	1 96	1
SI-2	CL	40	27	19 7	110	532	0 6	1 77	1 19	0 59	2
				18 2	113	491	1 7	3 43	2 57	0 87	2
				17 2	115	464	2 9	5 26	4 08	1 18	2
				15 9	118	430	6 1	10 11	8.11	2 01	2
PR-19	CH	62	48	25 4	101	.694	0 5	1 35	0 93	0 43	3
				24 7	102	.675	1 5	2 67	2 09	0 59	3
				23 1	104	631	3 2	5 71	4 46	1 26	3
				22 1	106	602	5 9	8 88	7 39	1 49	3
PR-20	CH	70	55	23 8	102	636	0 6	1 45	1 03	0 43	4
				23 1	103	615	1 6	2 69	2 15	0 55	4
				23 5	102	626	3 0	5 12	4 06	1 06	4
				20 5	108	546	6 0	9 18	7 59	1 59	4
PR-21	CH	51	37	26 0	100	709	0 6	1 46	1 04	0 44	5
				24 9	101	680	1 5	3 05	2 28	0 76	5
				24 8	102	676	2 8	4 49	3 65	0 85	5
				20 5	109	560	5 9	6 99	7 45	1 55	5

LEGEND

Class	Sample Classification According to the Unified Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
Wc	Water Content
γ_D	Unit Dry Weight
S_0	Saturation Before Shear
e_0	Void Ratio Before Shear
σ_3	Minor Principal Stress
σ_1	Major Principal Stress



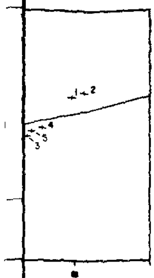
Q TRA



Sample No	Class
SI-1	CH
SI-2	CL
PR-19	CH
PR-20	CH
PR-21	CH

US ARMY

RACT



PLOT SYMBOL
1
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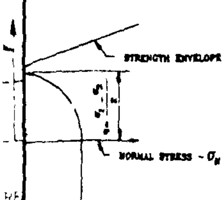
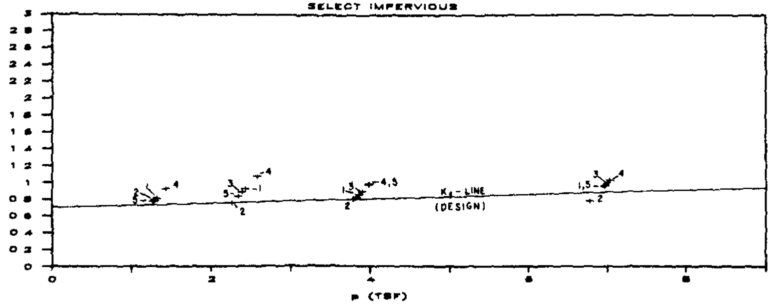
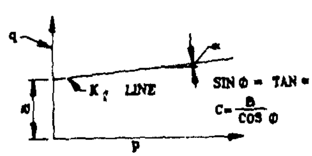


Q TEST—INITIAL & COMPLETION CONTRACT

SELECT IMPERVIOUS



Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	So (%)	e_o	σ_3 (TSF)	σ_1 (TSF)	p (TSF)	q (TSF)	PLOT SYMBOL
S1-1	CH	57	41	22.8	101	93	.665	0 5	2 13	1.32	0 82	1
				21 9	103	93	640	1 5	3.36	2 43	0 93	1
				22 8	102	95	652	3 0	4 72	3 86	0 86	1
				22 5	103	94	.646	6 0	7 92	6 96	0.96	1
S1-2	CL	40	27	17 8	109	90	.534	0 5	2 07	1 29	0 79	2
				18 0	109	89	.542	1 5	3 02	2 26	0 76	2
				18.4	108	90	550	3 0	4 65	3 83	0 83	2
				18 0	109	90	.538	6 0	7 55	6 78	0 78	2
PR-19	CH	62	48	23 9	103	100	650	1 5	3 27	2 39	0 89	3
				22 8	104	98	631	3 0	4 80	3 90	0 90	3
				23 1	104	99	633	6 0	8 00	7 00	1 00	3
PR-20	CH	70	55	23 9	101	100	637	0 5	2 35	1 43	0 93	4
				22 9	102	98	624	1 5	3 65	2 58	1 08	4
				23 4	102	99	628	3 0	4 96	3 98	0 98	4
				23 0	103	99	616	6.0	8 06	7 03	1 03	4
PR-21	CH	51	37	24 1	100	95	687	0 5	2 04	1 27	0 77	5
				23 7	101	95	.679	1 5	3 17	2 34	0 84	5
				22 6	102	93	661	3 0	4 98	3 99	0 99	5
				23 1	102	94	669	6 0	7 93	6 97	0 97	5



RELATIONSHIP OF "c" AND "Φ" TO K_f LINE ON p–q DIAGRAM

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

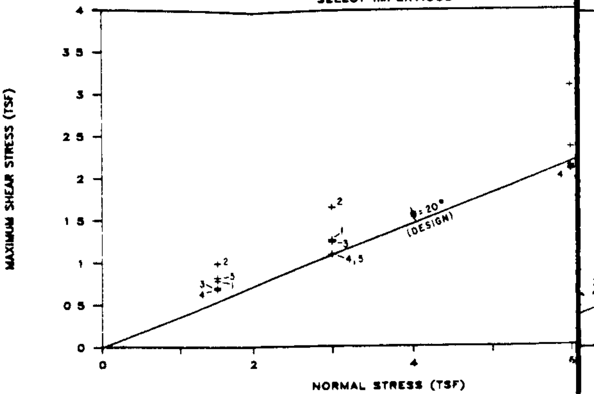
RECORD SAMPLE TEST RESULTS
"Q" AND "R" TRIAXIAL SHEAR TESTS
SELECT IMPERVIOUS FILL
INITIAL AND COMPLETION CONTRACTS

U S ARMY ENGINEER DISTRICT, FT WORTH

PLATE 77

S TEST–INITIAL & COMPLETION CO

SELECT IMPERVIOUS

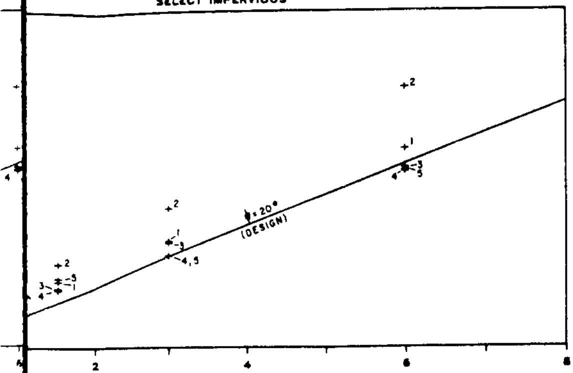


Sample No	Class	LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_0	Normal Stress (TSF)
SI-1	CH	57	41	21.5	106	.587	1 5
				21 6	106	593	3 0
				22.0	106	588	6 0
SI-2	CL	40	27	17.0	112	498	1 5
				15 6	116	.452	3 0
				17.3	112	.500	6 0
PR-19	CH	62	48	22 6	105	.621	1 5
				21.2	107	585	3.0
				22.2	105	.610	6.0
PR-20	CH	70	55	22 6	104	601	1 5
				22 7	102	625	3 0
				22.6	104	599	6 0
PR-21	CH	51	37	22 4	106	.606	1 5
				23 0	103	651	3 0
				22.0	106	.599	6 0

U S. ARMY

O T—INITIAL & COMPLETION CONTRACT

SELECT IMPERVIOUS



LL (%)	PI (%)	W_c (%)	γ_D (PCF)	e_0	Normal Stress (TSF)	Max. Shear Stress (TSF)	PLOT SYMBOL
57	41	21 5	106	587	1 5	0.80	1
		21 6	106	.593	3 0	1.27	1
		22 0	106	588	6 0	2 36	1
40	27	17.0	112	498	1 5	1 00	2
		15.6	116	.452	3 0	1 66	2
		17 3	112	.500	6.0	3 09	2
62	48	22.6	105	621	1 5	0.71	3
		21 2	107	585	3.0	1 25	3
		22 2	105	.610	6 0	2 14	3
70	55	22 6	104	.601	1.5	0.69	4
		22.7	102	625	3 0	1.10	4
		22 6	104	599	6 0	2 09	4
51	37	22 4	106	.606	1 5	0 83	5
		23 0	103	.651	3.0	1 10	5
		22 0	106	.599	6.0	2.11	5

LEGEND

Class	Sample Classification According to the Unified Soil Classification System
LL	Liquid Limit
PI	Plasticity Index
W_c	Water Content
γ_D	Unit Dry Weight
e_0	Void Ratio before Shear

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

RECORD SAMPLE TEST RESULTS

"S" DIRECT SHEAR TESTS
SELECT IMPERVIOUS FILL
INITIAL AND COMPLETION CONTRACTS

U S ARMY ENGINEER DISTRICT, FT WORTH

CORPS OF ENGINEERS

JOE POOL - COMPLETION CONTRACT - LABORATORY DATA FROM RECORD SAMPLE

Sample No	Zone	Sample Date	Test Date	Emb Station	Offset Emb CL (ft)	Elev (ft)	Class	LL (%)	PL (%)	BLS (%)	W_c (%)	γ_D (PCF)
PR-1*	Impervious	8/82	3/83	22+00	50 U/S	494	CH	74	20	--	26	97
PR-2*	Random	12/82	3/83	43+00	150 D/S	514	CH	72	20	--	24	102
PR-3*	Impervious	12/82	3/83	15+00	50 D/S	505	CH	69	19	--	25	99
PR-4*	Random	1/83	3/83	38+00	150 U/S	517	CH	68	18	--	28	97
PR-5	Random	3/83	8/83	23+00	50 D/S	520	CH	66	24	20	29	96
PR-6	Impervious	3/83	8/83	59+00	50 D/S	474	CH	68	19	19	30	96
PR-7	Impervious	6/83	11/83	35+00	0	531	CH	65	19	22	28	96
PR-8	Impervious	7/83	11/83	13+00	0	538	CH	70	20	23	28	97
PR-9	Random	7/83	11/83	69+00	200 D/S	491	CH	55	19	20	24	101
PR-10	Impervious	7/83	12/83	67+00	50 U/S	497	CH	56	18	20	25	101
PR-11	Random	10/83	4/84	58+00	170 D/S	509	CH	61	20	24	24	100
PR-12	Impervious	12/83	4/84	175+00	0	548	CL	49	15	18	26	97
PR-13	Impervious	1/84	8/84	69+00	0	531	CH	68	21	20	27	96
PR-14	Impervious	1/84	10/84	75+00	0	532	CH	62	19	19	28	96
PR-15	Random	2/84	10/84	146+00	50 U/S	542	CH	50	14	17	22	105
PR-16	Impervious	2/84	11/84	150+00	0	543	CH	54	14	16	23	104
PR-17	Impervious	5/84	3/85	96+00	0	546	CH	63	16	19	24	101
PR-18	Impervious	5/84	1/85	125+00	0	548	CL	39	13	13	21	106
PR 19	Sel Imp	5/84	3/85	94+00	50 U/S	547	CH	62	14	19	23	102
PR 20	Sel Imp	8/84	3/85	99+50	0	549	CH	70	15	19	23	103
PR-21	Sel Imp	8/84	6/85	100+50	0	549	CH	51	14	15	23	102
PR-22	Random	9/84	1/86	113+00	100 D/S	535	CH	61	16	21	27	104
PR-23	Impervious	3/85	3/86	50+00	50 U/S	494	CH	57	18	14	25	100
PR-24	Impervious	8/85	3/86	48+00	0	545	CH	66	21	17	25	99

* MRD Lab

** Compaction Test Result Redrawn Based on Engineering Judgment

JOE POOL - INITIAL CONTRACT - LABORATORY DATA FROM RECORD SAMPLE

Sample No	Zone	Sample Date	Test Date	Emb Station	Offset Emb CL (ft)	Elev (ft)	Class	LL (%)	PL (%)	BLS (%)	W_c (%)	γ_D (PCF)	G_s
I-1	Impervious	11/80	8/81	35+00	50 U/S	510	CH	68	22	22	26	98	2 75
I-2	Impervious	10/80	7/81	36+00	0	498	CH	66	18	19	25	101	2 72
I-3	Impervious	8/80	12/80	43+00	50 D/S	488	CH	64	19	19	28	97	2 73
I-4	Impervious	8/80	11/80	37+00	0	483	CH	65	20	20	26	97	2 73
I-5	Impervious	8/80	11/80	45+00	50 U/S	481	CH	63	19	18	25	100	2 74
I 6	Impervious	7/80	10/80	39+00	50 D/S	475	CH	63	17	18	25	101	2 74
I-250	Impervious	10/81	7/82	23+00*	50 LT*	483	CH	61	17	20	25	101	2 70
IU-240	Impervious	9/81	5/82	25+00*	50 RT*	471	CH	55	15	19	23	99	2 67
R-1	Random	10/80	7/81	36+00	150 U/S	498	CH	71	20	20	29	96	2 77
R-2	Random	7/80	10/80	42+00	200 U/S	478	CH	65	20	23	25	98	2 70
R-3	Random	7/80	10/80	44+00	100 U/S	476	CH	66	19	22	27	97	2 69
R-4	Random	10/80	7/81	33+00	100 D/S	508	CH	74	21	20	28	96	2 77
R-5	Random	8/80	12/80	32+00	200 D/S	488	CH	65	19	20	26	97	2 73
R-6	Random	8/80	11/80	39+00	100 D/S	481	CH	65	20	18	24	100	2 75
R-7	Random	8/80	11/80	42+00	200 D/S	478	CH	64	19	19	26	100	2 74
R-8	Random	11/80	7/81	40+00	100 U/S	508	CH	74	22	20	29	95	2 74
SI-1	Sel Imp	4/81	8/81	97+00	0	545	CH	57	16	18	22	105	2 7[illegible]
SI-2	Sel Imp	2/81	8/81	100+00	50 D/S	534	CL	40	13	.6	17	112	2 7[illegible]

* STATION AND OFFSET ARE WITH RESPECT TO THE OUTLET WORKS CHANNEL

JOE POOL - COMPLETION CONTRACT - LABORATORY DATA FROM RECORD SAMPLES

Emb Station	Offset Emb CL (ft)	Elev (ft)	Class	LL (%)	PL (%)	SL (%)	W_c (%)	γ_D (PCF)	G_s	% Gravel	% Sand	% Fines
22+00	50 U/S	494	CH	74	20	--	26	97	2 79	0	5	95
43+00	150 D/S	514	CH	72	20	--	24	102	2 81	3	7	90
15+00	50 D/S	505	CH	69	19	--	25	99	2 81	0	10	90
38+00	150 U/S	517	CH	68	18	--	28	97	2 77	2	6	92
23+00	50 D/S	520	CH	66	24	20	29	96	2 72	4	9	87
59+00	50 D/S	474	CH	68	19	19	30	96	2 74	4	5	91
35+00	0	531	CH	65	19	22	28	96	2 72	0	3	97
13+00	0	538	CH	70	20	23	28	97	2 71	0	2	98
69+00	200 D/S	491	CH	55	19	20	24	101	2 74	1	9	90
67+00	50 U/S	497	CH	56	18	20	25	101	2 76	5	8	87
58+00	170 D/S	509	CH	61	20	24	24	100	2 71	1	4	95
175+00	0	548	CL	49	15	18	26	97	2 69	0	14	86
69+00	0	531	CH	68	21	20	27	96	2 72	0	5	95
75+00	0	532	CH	62	19	19	28	96	2 72	0	8	92
146+00	50 U/S	542	CH	50	14	17	22	105	2 70	0	21	79
150+00	0	543	CH	54	14	16	23	104	2 70	2	18	80
96+00	0	546	CH	63	16	19	24	101	2 73	4	17	79
125+00	0	548	CL	39	13	13	21	106	2 68	3	30	67
94+00	50 U/S	547	CH	62	14	19	23	102	2 73	1	34	65
99+50	0	549	CH	70	15	19	23	103	2 67	6	21	73
100+50	0	549	CH	51	14	15	23	102	2 73	4	17	79
113+00	100 D/S	535	CH	61	16	21	23	104	2 69	0	11	89
50+00	50 U/S	494	CH	57	18	14	25	100	2 72	0	11	89
48+00	0	545	CH	66	21	17	25	99	2 68	0	4	96

Engineering Judgment

JOE POOL - INITIAL CONTRACT - LABORATORY DATA FROM RECORD SAMPLES

Emb Station	Offset Emb CL (ft)	Elev (ft)	Class	LL (%)	PL (%)	SL (%)	W_c (%)	γ_D (PCF)	G_s	% Gravel	% Sand	% Fines
35+00	50 U/S	510	CH	68	22	22	26	98	2 75	1	6	93
36+00	0	498	CH	66	18	19	25	101	2 72	0	5	95
41+00	50 D/S	488	CH	64	19	19	28	97	2.73	0	5	95
37+00	0	483	CH	65	20	20	26	97	2 73	0	4	96
45+00	50 U/S	481	CH	63	19	18	25	100	2 74	0	5	95
39+00	50 D/S	475	CH	63	17	18	25	101	2 74	0	5	95
23+00*	50 LT*	48?	CH	61	17	20	25	101	2 70	0	7	93
25+00*	50 RT*	471	CH	55	15	19	23	99	2 67	0	10	90
36+00	150 U/S	498	CH	71	20	20	29	96	2 77	0	8	92
42+00	200 U/S	478	CH	65	20	23	25	98	2 70	0	4	96
44+00	100 U/S	476	CH	66	19	22	27	97	2 69	0	5	95
33+00	100 D/S	506	CH	74	21	20	28	96	2 72	6	7	87
37+00	200 D/S	488	CH	65	19	20	26	97	2 73	0	4	96
39+00	100 D/S	481	CH	65	20	18	24	100	2 75	0	4	96
42+00	200 D/S	478	CH	64	19	19	26	100	2 74	0	3	97
40+00	100 U/S	508	CH	74	22	20	29	95	2 74	3	7	90
97+00	0	545	CH	57	16	18	22	105	2 72	10	27	63
00+00	50 D/S	534	CL	40	13	16	17	112	2 70	3	37	60

TO THE OUTLET WORKS CHANNEL

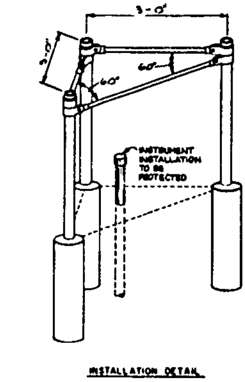
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

RECORD SAMPLE TEST SUMMARY

INITIAL AND COMPLETION CONTRACTS

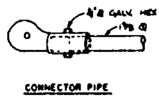
US ARMY ENGINEER DISTRICT, FT WORTH

PLATE 79

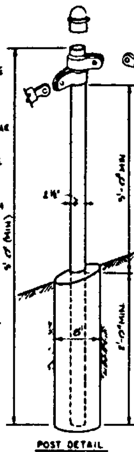


INSTALLATION DETAIL

NOTE: 3-2½"G.I. FENCE POSTS CONNECTED BY 1⅝" TOP RAILS TO BE INSTALLED AROUND EACH ITEM LISTED IN THE SCHEDULE ON THIS SHEET. POSTS WILL BE LOCATED IN SUCH A MANNER THAT WILL ALLOW A CLEAR LINE OF SIGHT BOTH PERPENDICULAR AND PARALLEL TO THE CENTERLINE OF THE DAM. FENCES ARE TO BE INSTALLED AFTER EACH INSTALLATION IS COMPLETE. PROTECTIVE FENCES TO BE PAINTED WITH TWO COATS OF ALUMINUM PAINT. ALL FENCES WILL BE FURNISHED WITH TAGS VISIBLE FROM BOTH THE UPSTREAM AND DOWNSTREAM SIDES IDENTIFYING THE INSTRUMENTATION WITHIN THE FENCE. LETTERS SHALL BE 3-INCH BLOCK LETTERS SHOWING BOTH THE PREFIX AND THE NUMBER OF THE INSTRUMENT.



CONNECTOR PIPE AND FITTING DETAIL



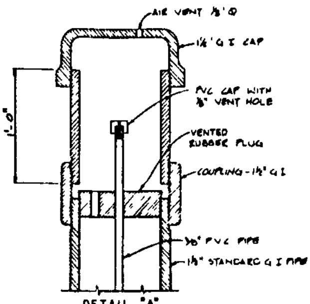
POST DETAIL

NOTE 1

POST TO BE 2½" x 5'-0"(MIN) HEAVY DUTY STEEL (WEIGHT APPROX 12 LB PER L F) GALV INSIDE AND OUT, INSTALLED IN A PLUMB POSITION EMBEDDED IN MIN 8" Ø CONCRETE 2'-0" DEEP. POST LENGTH SHALL VARY SUCH THAT CONNECTOR PIPES ARE INSTALLED IN A LEVEL POSITION. CONNECTOR PIPE AND FITTINGS TO BE COMPATIBLE WITH POST AS SHOWN.

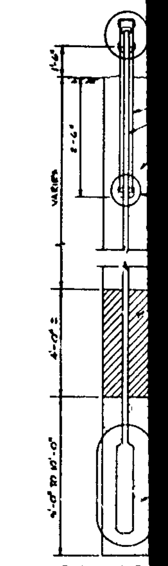
PROTECTIVE FENCE DETAIL (METAL)

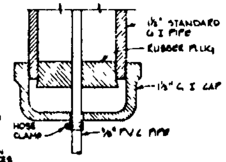
NOT TO SCALE



DETAIL "A"

NOT TO SCALE





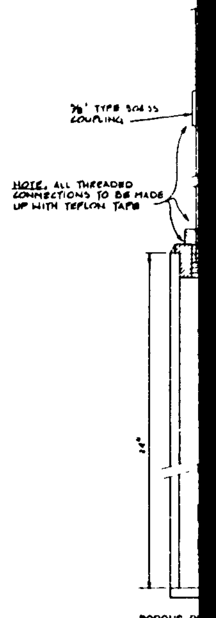
DETAIL "B"

NOT TO SCALE

NOTES ON INSTALLATION OF PIEZOMETERS

1 ELEVATIONS OF PIEZOMETER TIPS ARE APPROXIMATE, FINAL ELEVATIONS WILL BE DETERMINED AT THE TIME OF INSTALLATION.
2 THE CONTRACTOR SHALL PROVIDE ALL MATERIALS FOR PIEZOMETERS AND EXTEND ALL PIPING IN A PLUMB POSITION. PIEZOMETERS SHALL BE INSTALLED BY GOVERNMENT FORCES.
3 THE CONTRACTOR SHALL STAMP THE PIEZOMETER NUMBER, PREFIXED BY THE LETTER "P" ON THE TOP OF EACH PIEZOMETER CAP AND NEAR THE TOP OF THE EXPOSED REMOVABLE SECTION OF CASING.
4. THE CEMENT-BENTONITE GROUT BACKFILL SHALL BE MIXED IN THE PROPORTIONS BY VOLUME AND WEIGHT SEVEN AND ONE HALF GALLONS OF WATER, FIVE POUNDS BENTONITE AND ONE 94 POUND SACK OF CEMENT. THE GROUT SHALL BE THOROUGHLY MIXED TO A UNIFORM CONSISTENCY BEFORE BACKFILLING.
5 SELECT SAND FILTER FOR THE PIEZOMETER SENSING ZONE SHALL BE WITHIN THE FOLLOWING GRADATION LIMITS.

SIEVE SIZE (SQUARE MESH)	PERCENT PASSING (BY WEIGHT)
⅜ INCH	100
NO 4	91-100
NO 8	75 90
NO 16	60-75
NO 30	34-41
NO 50	10 20
NO 100	0 - 4

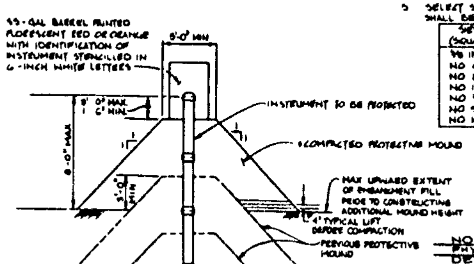


POROUS P

NOT T

NOTE:

SIMILAR POROUS PLASTIC TIPS ARE
OMETER RESEARCH AND DEVELOPM
CONNECTICUT 06901, PHONE NO
IS UNASSEMBLED, THE CONTRACT
LABOR TO COMPLETELY ASSEMBLE
CONTRACTING OFFICER AT NO AD



TEMPORARY INSTRUMENTATION PROTECTION

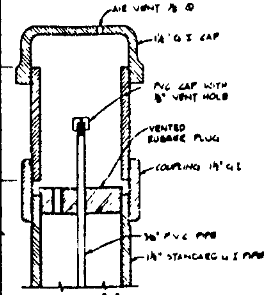
NOT TO SCALE

* SEE NOTES ON TEMPORARY PHYSICAL MEASUREMENT DEVICE PROTECTION, THIS SHEET, AND THE CONTRACT SPECIFICATIONS

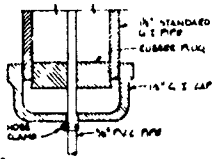
NOTES ON TEMPORARY PHYSICAL MEASUREMENT DEVICE PROTECTION

1 SLOPES SHOWN ARE THE STEEPEST SLOPES PERMITTED
2 COMPACTED FILL (THE SAME TYPE AS SURROUNDING FILL) WITHIN THE LIMITS SHOWN SHALL BE PLACED IN 4-INCH LAYERS, COMPACTED BY POWER TAMPERS TO DENSITY AND MOISTURE CONTENT SPECIFIED FOR THE SURROUNDING FILL AND KEPT IN THE SAME CONDITION AS SPECIFIED FOR ADJACENT COMPACTED FILL.
3 THE COMPACTED PROTECTIVE FILL AROUND PHYSICAL MEASUREMENT DEVICES SHALL BE PLACED WITHIN SIX HOURS AFTER EXTENSIONS ARE ADDED.
4 THE TEMPORARY PROTECTION SHOWN SHALL BE A MINIMUM CONTRACTOR EFFORT. "ADDITIONAL EFFORTS AS REQUIRED" IS ALSO A CONTRACT REQUIREMENT AS PROVIDED IN THE SPECIFICATIONS.

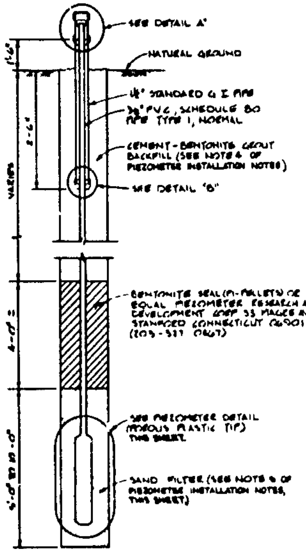
2½" x 5'-0"(MIN) HEAVY DUTY
...HT APPROX 12 LB. PER L.F.) GALV
...OUT, INSTALLED IN A PLUMB POSITION,
... MIN 8" Ø CONCRETE 2'-0" DEEP
... SHALL VARY SUCH THAT CONNECTOR
...NSTALLED IN A LEVEL POSITION
... PIPE AND FITTINGS TO BE COMPATIBLE
... AS SHOWN



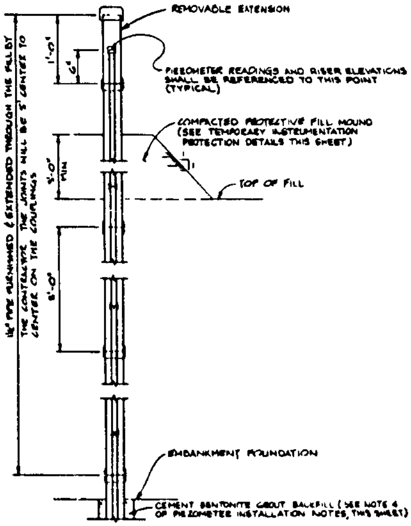
DETAIL "A"
NOT TO SCALE



DETAIL "B"
NOT TO SCALE

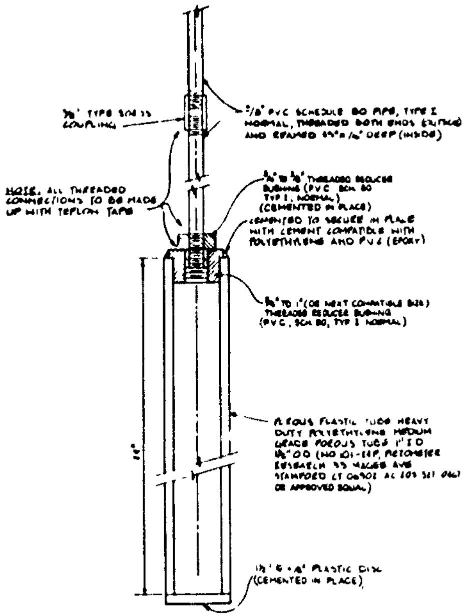


EMBANKMENT FOUNDATION
POROUS PLASTIC TIP PIEZOMETER DETAIL
NOT TO SCALE



EMBANKMENT FOUNDATION
POROUS PLASTIC TIP PIEZOMETER
EXTENSION DETAIL *
INSTALLATION WITHIN LIMITS
OF EMBANKMENT
NOT TO SCALE

* SIMILAR FOR EXTENSION OF SETTLEMENT PLATES AND DEEP SETTLEMENT PLATES



POROUS PLASTIC TIP
NOT TO SCALE

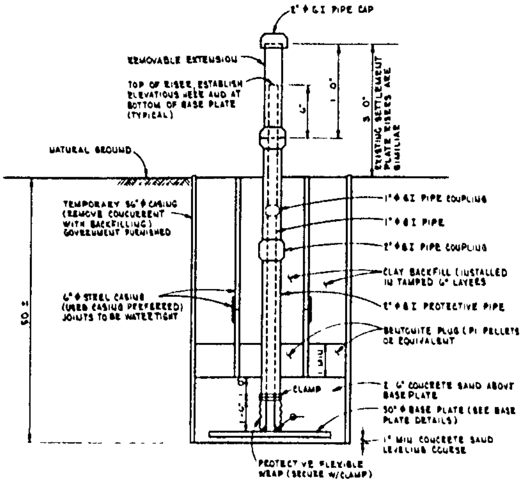
NOTE
SIMILAR POROUS PLASTIC TIPS ALREADY ASSEMBLED MAY BE AVAILABLE FROM THE PIEZOMETER RESEARCH AND DEVELOPMENT CORP 33 MAGEE AVE, STAMFORD CONNECTICUT 06901, PHONE NO 203 327-0467. IF CONTRACTOR FURNISHED EQUIPMENT IS UNASSEMBLED, THE CONTRACTOR SHALL FURNISH SUFFICIENT TOOLS AND QUALIFIED LABOR TO COMPLETELY ASSEMBLE PIEZOMETER TIPS UNDER SUPERVISION OF THE CONTRACTING OFFICER AT NO ADDITIONAL COST TO THE GOVERNMENT

...TED
...ILL)
...CH
...AND
...G FILL
...ADJACENT
...MEASUREMENT
...TEE
...NTRACTOR EFFORT
...EMENT AS

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY T. SCHMIDT	JOE POOL LAKE MOUNTAIN CREEK TEXAS
DRAWN BY EWB/JEO	EMBANKMENT, SPILLWAY, AND OUTLET WORKS
REVIEWED BY T. SCHMIDT	PHYSICAL MEASUREMENT DEVICES-I
SUBMITTED BY H. R. STROMAN	INV NO DACW63 81-B-0093 DATE: JULY 1981 SHEET NO 19 of 43 23

PLATE 80



DEEP BENCH MARK DETAIL AND DEEP SETTLEMENT PLATE DETAIL

NTS

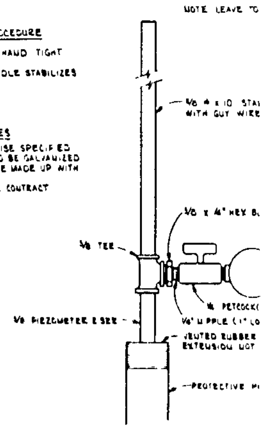
TOP OF CAP DETAIL

READING PROCEDURE

1. INSTALL GAGE HAND TIGHT
2. OPEN PETCOCK
3. WHEN GAGE NEEDLE STABILIZES MAKE READING
4. CLOSE PETCOCK
5. REMOVE GAGE

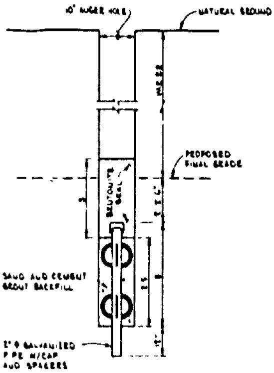
NOTES

1. UNLESS OTHERWISE SPECIFIED ALL FITTINGS TO BE GALVANIZED
2. ALL JOINTS TO BE MADE UP WITH TEFLON TAPE
3. REFERENCE THE CONTRACT SPECIFICATIONS



PROCEDURE FOR FLOWING PIEZ

NTS



HEAVE POINT DETAIL

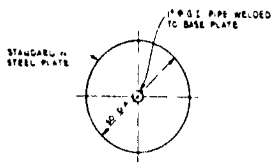
NTS

NOTES

1. IF BORING CAVES OR SQUEEZES TEMPORARY CASING SHOULD BE SET
2. PRIOR TO BACKFILLING THE ELEVATION OF THE TOP OF PIPE CAP SHOULD BE ESTABLISHED
3. AFTER SURVEY IS COMPLETE THE CASING SHOULD BE PULLED AND THE HOLE BACKFILLED

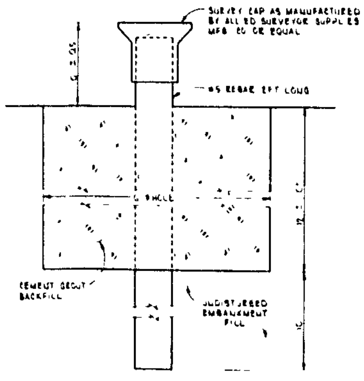
NOTES ON INSTALLATION OF DEEP BENCH MARK PLATES

1. THE BASE PLATE AND ANY OTHER NON GALVANIZED SURFACES SHALL BE COATED WITH PROTECTIVE PAINT (RED LEAD BASE COAT AND ALUMINUM OUTER COAT)
2. THE CONTRACTOR SHALL STAMP THE BENCH MARK NUMBER PREFIXED BY THE LETTERS DBM ON THE TOP OF EACH BENCH MARK CAP AND NEAR THE TOP OF THE PROTECTIVE PIPE
3. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS EXCEPT TEMPORARY 36" CASING
4. DEEP BENCH MARKS SHALL BE INSTALLED BY GOVERNMENT FORCES



30" Φ BASE PLATE DETAIL

NTS



EMBANKMENT STATION MONUMENT DETAIL

NTS

EMBANKMENT STATION MONUMENTS INSTALLATION NOTES

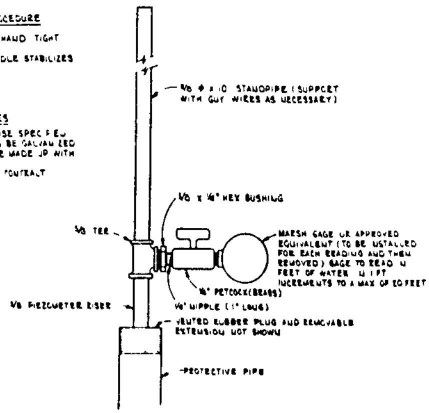
1. THE MONUMENTS SHALL BE INSTALLED AT EVERY WHOLE NUMBERED STATION ON THE DOWNSTREAM SIDE OF THE DAM CREST FROM STATION 5+00 TO STATION 29+00
2. THE MONUMENTS SHALL BE CONTRACTOR FURNISHED AND INSTALLED
3. THE MONUMENTS SHALL BE INSTALLED CONCURRENT WITH THE GUARDRAIL CONSTRUCTION. THE MONUMENTS WILL BE INSTALLED ALONG THE CENTERLINE OF THE GUARDRAIL POSTS AND THE GUARDRAIL POSTS SHALL NOT BE INSTALLED WITHIN 1 FOOT OF A WHOLE NUMBERED STATION
4. THE STATION NUMBER SHALL BE STAMPED ON TOP OF THE MONUMENTS AS SHOWN

READING PROCEDURE

1. INSTALL GAGE HAND TIGHT
2. OPEN PETCOCK
3. WHEN GAGE NEEDLE STABILIZES MAKE READING
4. CLOSE PETCOCK
5. REMOVE GAGE

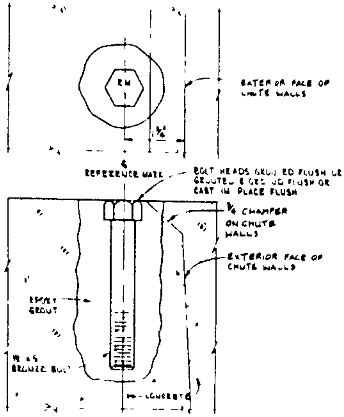
NOTES

1. UNLESS OTHERWISE SPECIFIED ALL FITTINGS TO BE GALVANIZED
2. ALL JOINTS TO BE MADE UP WITH TEFLON TAPE
3. REFERENCE THE CONTRACT SPECIFICATIONS



PROCEDURE FOR FLOWING PIEZOMETERS

NTS



SPILLWAY REFERENCE MARK DETAILS*

(TYPICAL)

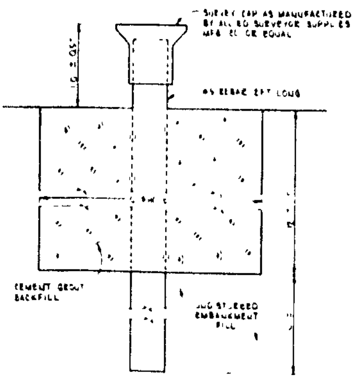
NTS

*** OUTLET WORKS REFERENCE PINS ARE SIMILAR**

NOTES ON REFERENCE MARKS

1. REFERENCE MARKS TO BE INSTALLED AS SHOWN ON SEQ 22 ON THE STILLING BASIN FLOOR AND WALLS
2. AT THE CONTRACTORS OPTION THE REFERENCE MARKS MAY BE CAST IN PLACE WITH STRUCTURAL CONCRETE
3. BRONZE BOLT TO CONFORM TO FED SPECS QQ B 750 AND AM 2

TOP OF CAP DETAIL



[E]MBANKMENT STATION MONUMENT DETAIL

NTS

EMBANKMENT STATION MONUMENTS INSTALLATION NOTES

1. THE MONUMENTS SHALL BE INSTALLED AT EVERY WHOLE NUMBERED STATION ON THE DOWNSTREAM SIDE OF THE DAM CREST FROM STATION 5+00 TO STATION 29+00
2. THE MONUMENTS SHALL BE CONTRACTOR FURNISHED AND INSTALLED
3. THE MONUMENTS SHALL BE INSTALLED CONCURRENT WITH THE GUARDRAIL CONSTRUCTION THE MONUMENTS WILL BE INSTALLED ALONG THE CENTERLINE OF THE GUARDRAIL POSTS AND THE GUARDRAIL POSTS SHALL NOT BE INSTALLED WITHIN 1 FOOT OF A WHOLE NUMBERED STATION
4. THE STATION NUMBER SHALL BE STAMPED ON TOP OF THE MONUMENTS AS SHOWN

PHYSICAL MEASUREMENT DEVICES		INSTALLATION AND READING SCHEDULE			
INSTRUMENT	INSTALLED BY	READ BY	PROTECTED BY	EXTENDED BY	READINGS SCHEDULE *
PIEZOMETERS (COMPLETION CONTRACT)	GOVERNMENT	CONTRACTOR (USE REGISTERED PUBLIC SURVEYOR)	CONTRACTOR	CONTRACTOR	1 UPON INSTALLATION 2 EVERY 7 CALENDAR DAYS FOR THE DURATION OF CONTRACT 3 WHEN 4 FEET OF FILL HAS BEEN PLACED 4 BEFORE AND AFTER EACH INCREMENT OF RISER IS ADDED 5 UPON RESTORATION OF ANY DAMAGE
** PIEZOMETERS	PREVIOUS CONTRACT	CONTRACTOR (USE REGISTERED PUBLIC SURVEYOR)	CONTRACTOR	CONTRACTOR	
** SETTLEMENT GAGES	PREVIOUS CONTRACT	CONTRACTOR (USE REGISTERED PUBLIC SURVEYOR)	CONTRACTOR	CONTRACTOR	
** DEEP SETTLEMENT PLATES	PREVIOUS CONTRACT	CONTRACTOR (USE REGISTERED PUBLIC SURVEYOR)	CONTRACTOR	CONTRACTOR	
NETWORK OF DEEP BENCH MARKS	GOVERNMENT	CONTRACTOR (USE REGISTERED PUBLIC SURVEYOR)	CONTRACTOR	N/A	SEE SPECIFICATIONS
REFERENCE PINS (OUTLET WORKS)	N/A	GOVERNMENT	N/A	N/A	AS DETERMINED BY THE CONTRACTING OFFICER
SURFACE REFERENCE MARKS (SPILLWAY)	CONTRACTOR	GOVERNMENT	CONTRACTOR	N/A	AS DETERMINED BY THE CONTRACTING OFFICER
HEAVE POINTS	GOVERNMENT	GOVERNMENT	CONTRACTOR	N/A	1 UPON INSTALLATION 2 WHEN SPILLWAY EXCAVATION IS COMPLETE

* THE CONTRACTING OFFICER WILL MAKE ADDITIONAL READINGS ON ANY SCHEDULE DETERMINED NECESSARY IN ADDITION TO THOSE MADE BY THE CONTRACTOR

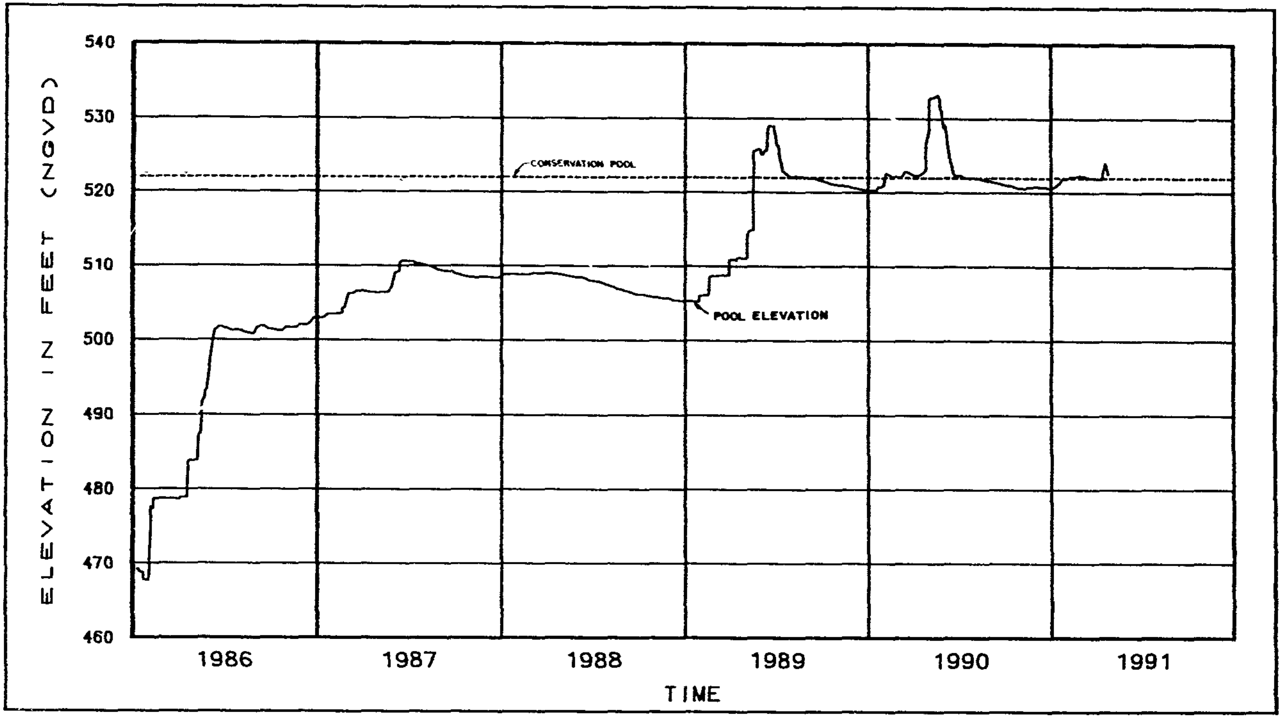
** THE CONTRACTOR SHALL REMOVE INSTRUMENT RISERS IN 5 FEET SECTIONS CONCURRENT WITH THE SPILLWAY EXCAVATION AND REASSEMBLE (EXTEND) AS BACKFILL IS PLACED

GENERAL NOTES

1. SEE SEQ 23 FOR TEMPORARY AND PERMANENT PROTECTION DETAILS FOR PHYSICAL MEASUREMENT DEVICES
2. SEE SEQ 20 THRU 21 FOR NETWORK OF DEEP BENCH MARKS

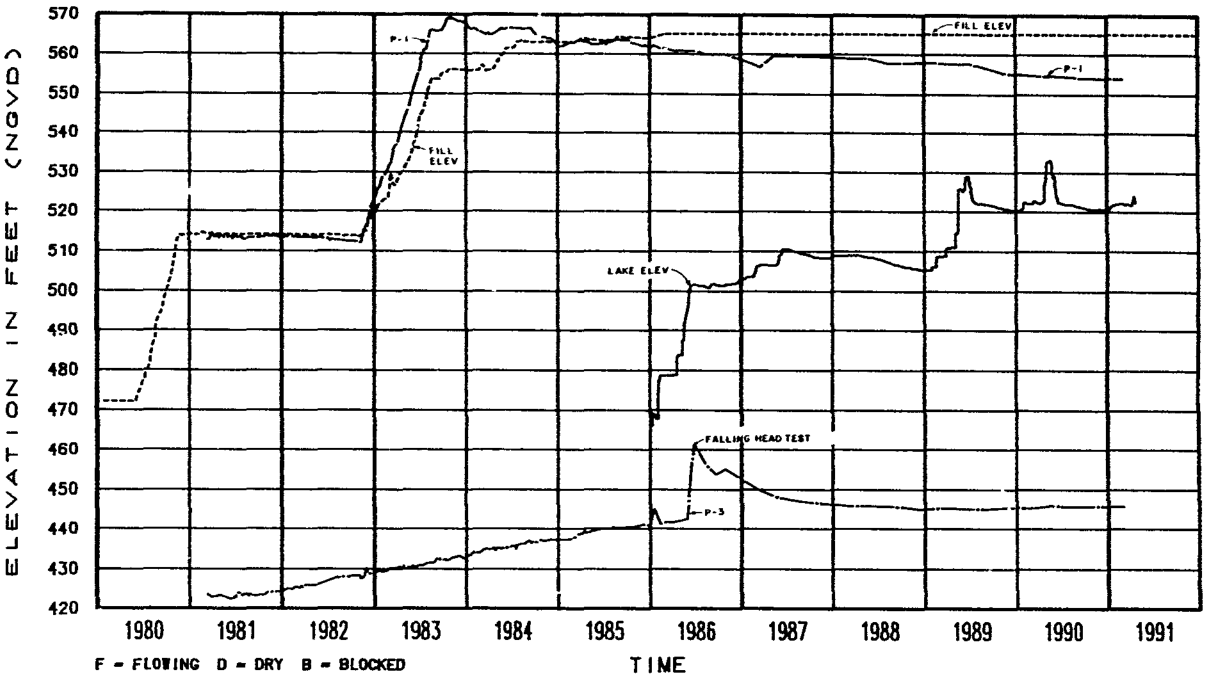
U S ARMY ENGINEER DISTRICT FORT WORTH CORPS OF ENGINEERS FORT WORTH TEXAS	
DESIGNED BY: T SCHMIDT, M SIMMONS	**JOE POOL LAKE** MOUNTAIN CREEK TEXAS
DRAWN BY: M PITTS	EMBANKMENT, SPILLWAY, AND OUTLET WORKS
REVIEWED BY: T SCHMIDT	PHYSICAL MEASUREMENT DEVICES-II
SUBMITTED BY: R S RUSHAR	INV NO DACW63 -P- 8-C093 DATED JULY 1981 DRAWING NUMBER SHEET NO 22 OF 43 SEQUENCE NO 24

PLATE 81

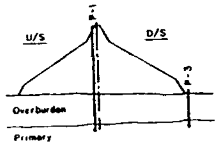


LAKE ELEV
CONSERVATION POOL ELEV=522.00
SPILLWAY CREST ELEV=541.00
DELIBERATE IMPOUNDMENT BEGAN 07JAN86
RECORD POOL ELEV & DATE 533.21 20MAY90

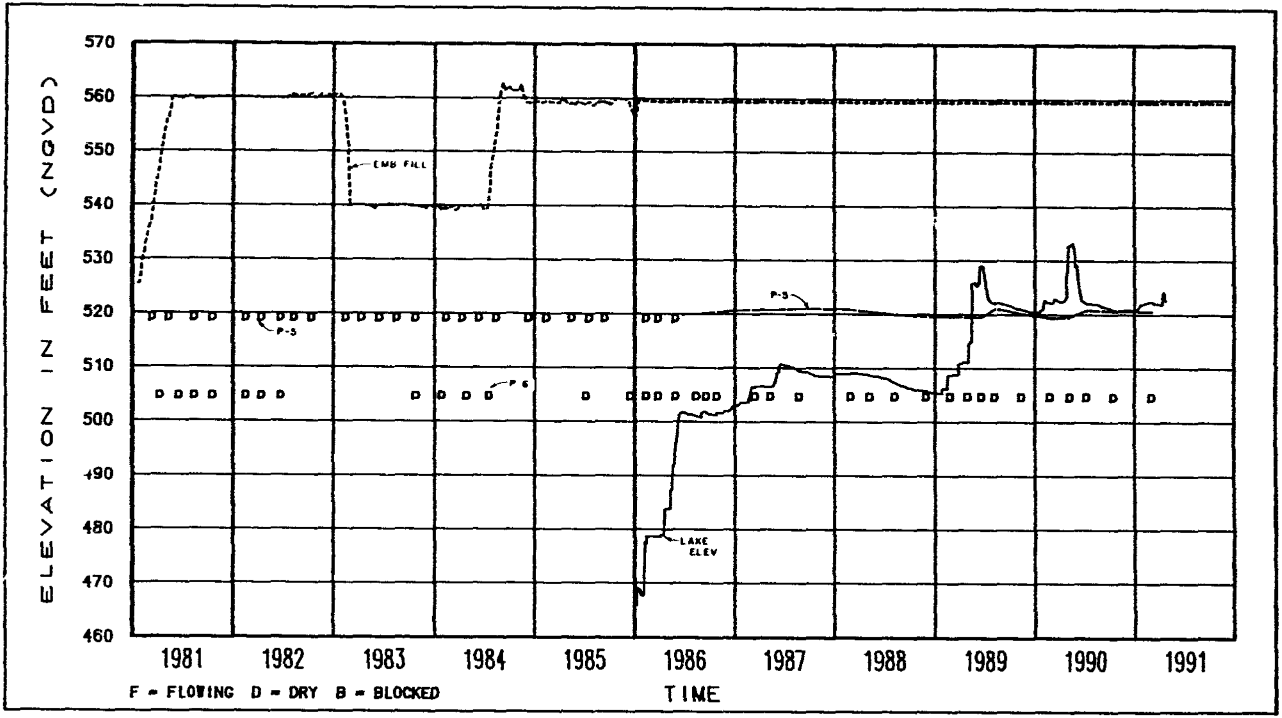
JOE POOL LAKE
FORT WORTH DISTRICT
LAKE ELEV. vs. TIME
EXHIBIT



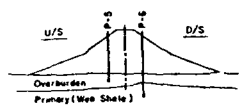
PIEZ. NO.	STATION	OFFSET	TIP ELEV.	FORMATION	LEGEND
LAKE ELEV					———
FILL	38+30		TOP OF	EMB FILL	- - - - -
P-1	38+30	15 U/S	419.35	CLAY SHALE	———
P-3	38+20	600 D/S	417.64	CLAY SHALE	———



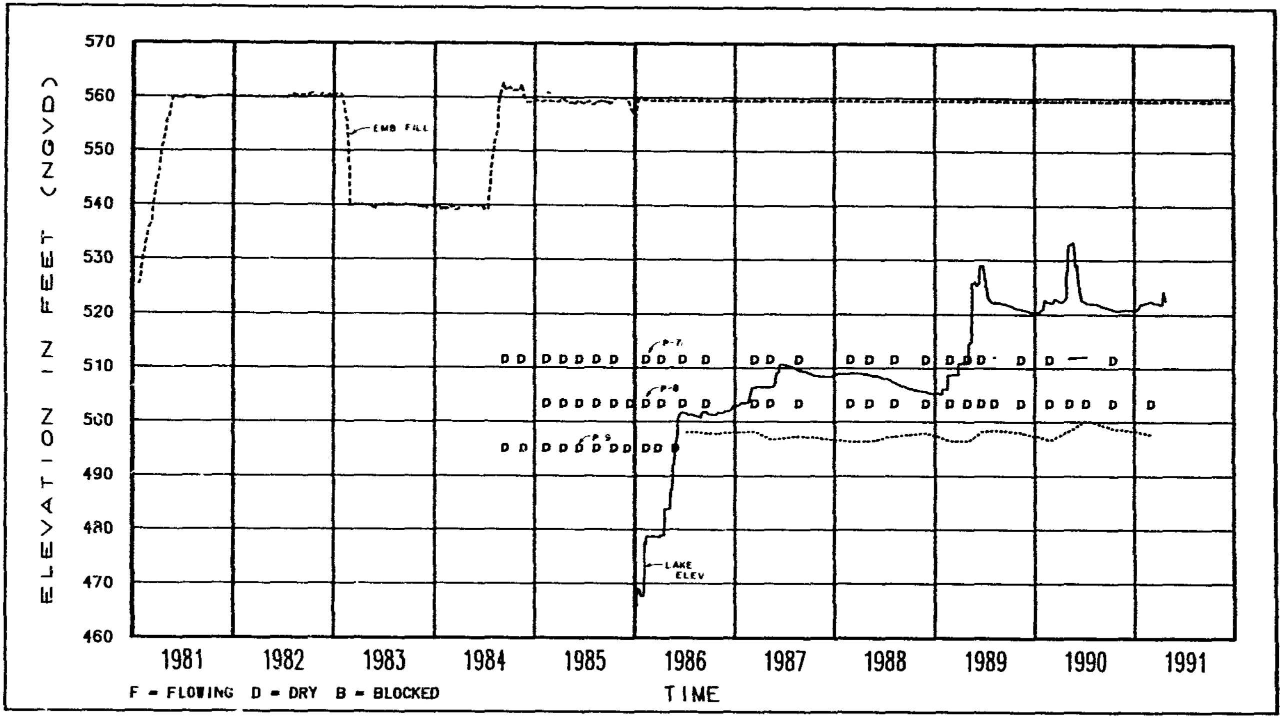
JOE POOL LAKE
FORT WORTH DISTRICT
PIEZOMETERS
FILL-E,P-1,P-3
PIEZOMETRIC ELEV. vs. TIME
EXHIBIT



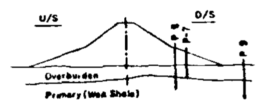
PIEZ. NO.	STATION	OFFSET	TIP ELEV.	FORMATION	LEGEND
LAKE ELEV					———
FILL	99+50		TOP OF	EMB FILL	--------
P-5	99+50	35 U/S	519.10	OVERBURDEN	———
P-6	99+30	30 D/S	504.63	CLAY SHALE(WEA)	———



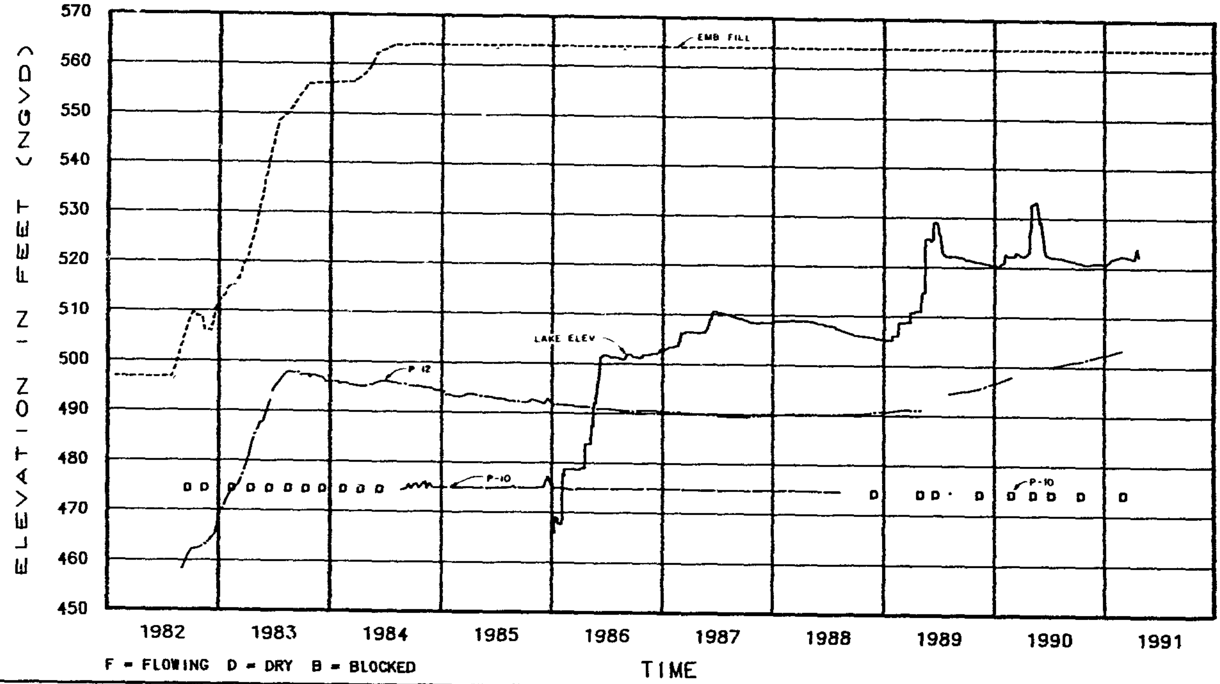
JOE POOL LAKE
FORT WORTH DISTRICT
PIEZOMETERS
FILL-H,P-5,P-6
PIEZOMETRIC ELEV. vs. TIME
EXHIBIT



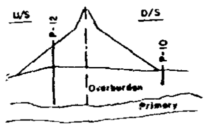
PIEZ. NO.	STATION	OFFSET	TIP ELEV.	FORMATION	LEGEND
LAKE ELEV					———
FILL	99+50		TOP OF	EMB FILL	- - - - -
P-7	100+50	105 D/S	511.53	OVERBURDEN	———
P-8	100+50	85 D/S	503.44	CLAY SHALE(Wea)	———
P-9	100+50	205 D/S	495.10	CLAY SHALE(Wea)	········



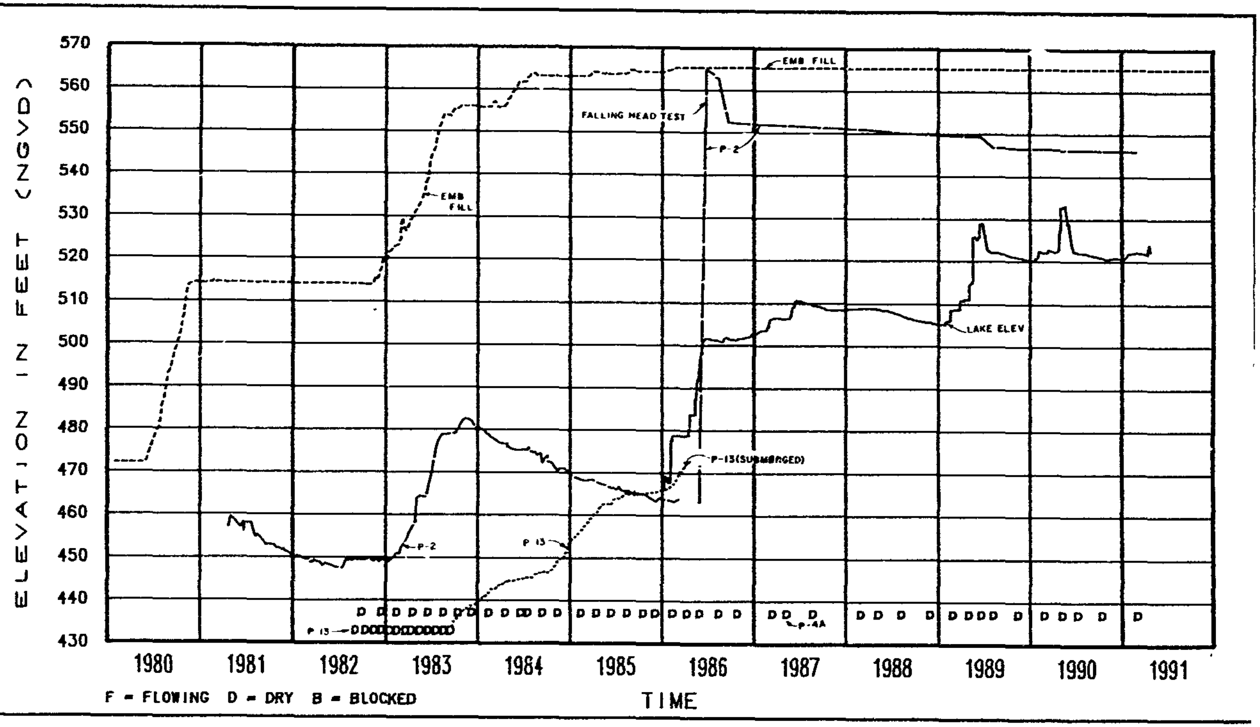
JOE POOL LAKE
FORT WORTH DISTRICT
PIEZOMETERS
FILL-H,P-7,P-8,P-9
PIEZOMETRIC ELEV. vs. TIME
EXHIBIT



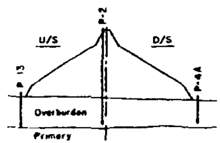
PIEZ. NO.	STATION	OFFSET	TIP ELEV.	FORMATION	LEGEND
LAKE ELEV					
FILL	16+00		TOP OF	EMB FILL	
P-10	15+70	508 D/S	474.15	OVERBURDEN	
P-12	16+10	220 U/S	454.66	CLAY SHALE	



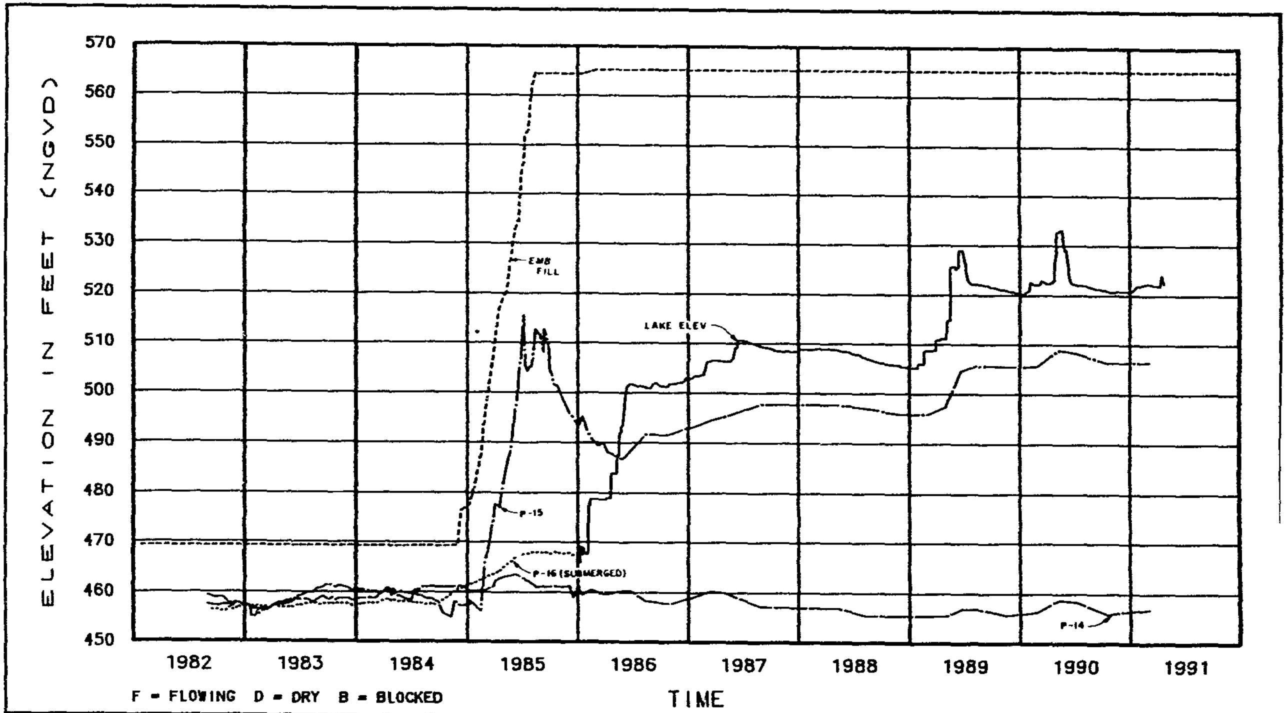
JOE POOL LAKE
FORT WORTH DISTRICT
PIEZOMETERS
FILL-D,P-10,P-12
PIEZOMETRIC ELEV. vs. TIME
EXHIBIT



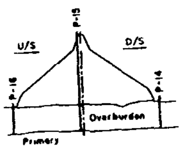
PIEZ. NO.	STATION	OFFSET	TIP ELEV.	FORMATION	LEGEND
LAKE ELEV					————
FILL	38+30		TOP OF	EMB FILL	- - - - - -
P-2	38+59	15 U/S	440.52	OVERBURDEN	—— ——
P-4A	38+66	600 D/S	437.17	OVERBURDEN	——-——
P-13	38+50	563 U/S	432.96	OVERBURDEN	-- ....



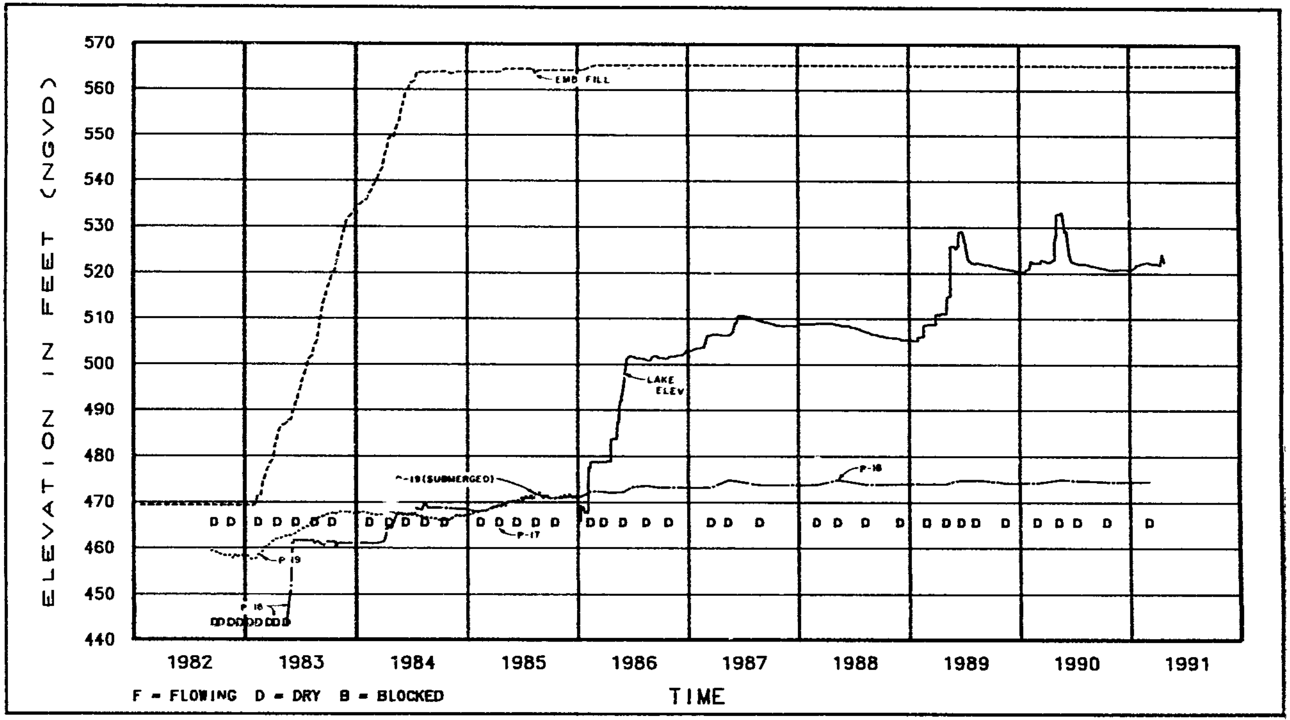
JOE POOL LAKE
FORT WORTH DISTRICT
PIEZOMETERS
FILL-E,P-2,P-4A,P-13
PIEZOMETRIC ELEV. vs. TIME
EXHIBIT



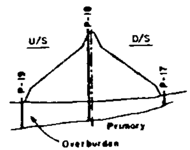
PIEZ. NO.	STATION	OFFSET	TIP ELEV.	FORMATION	LEGEND
LAKE ELEV					
FILL	50+00		TOP OF	EMB FILL	
P-14	50+00	610 D/S	434.52	OVERBURDEN	
P-15	49+95	15 U/S	433.94	OVERBURDEN	
P-16	50+00	600 U/S	435.24	OVERBURDEN	



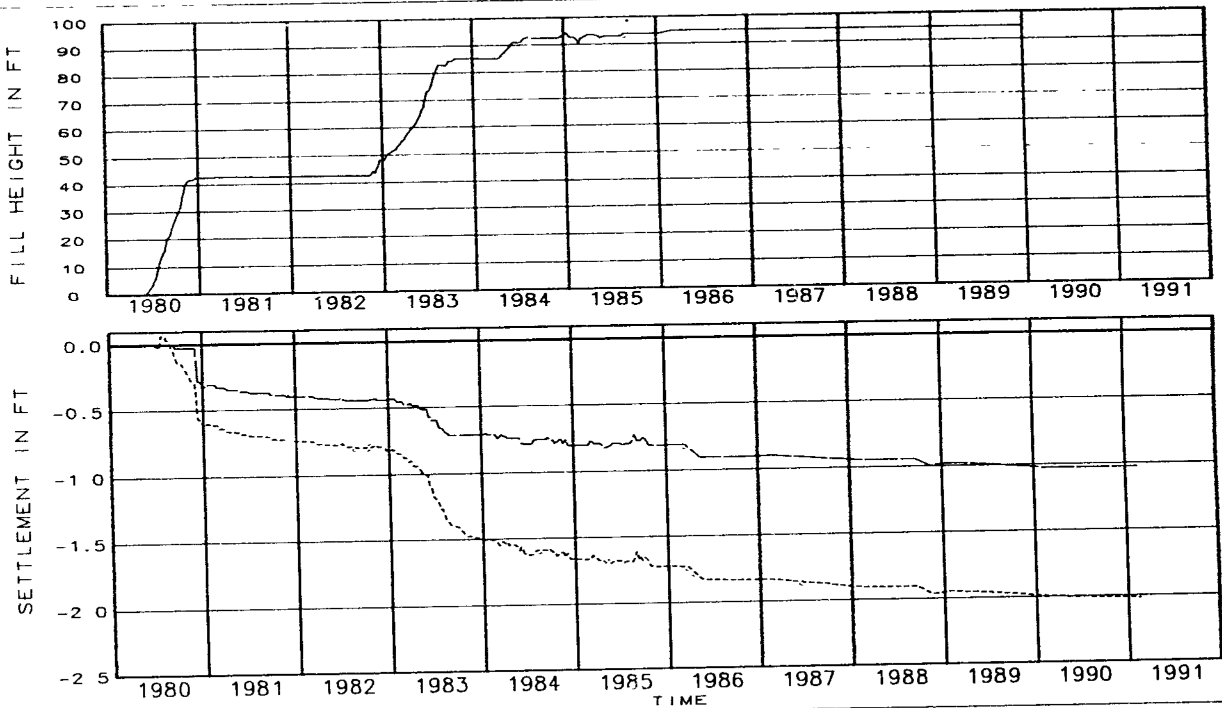
JOE POOL LAKE
FORT WORTH DISTRICT
PIEZOMETERS
FILL-F,P-14,P-15,P-16
PIEZOMETRIC ELEV. vs. TIME
EXHIBIT



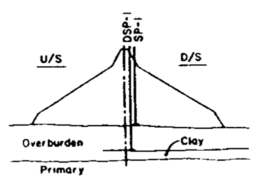
PIEZ. NO.	STATION	OFFSET	TIP ELEV.	FORMATION	LEGEND
LAKE ELEV					
FILL	63+00		TOP OF	EMB FILL	
P-17	63+00	577 D/S	465.65	OVERBURDEN	
P-18	63+00	15 U/S	443.73	OVERBURDEN	
P-19	63+00	616 U/S	437.67	OVERBURDEN	



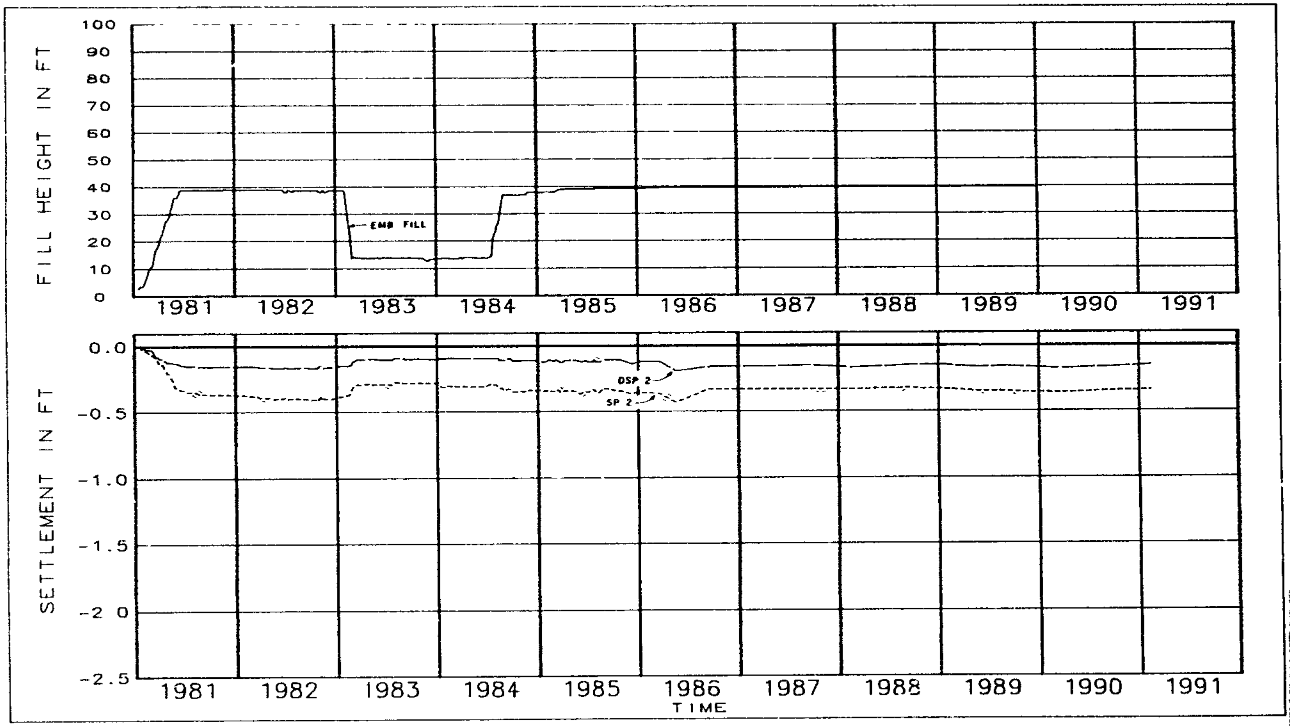
JOE POOL LAKE
FORT WORTH DISTRICT
PIEZOMETERS
FILL-G,P-17,P-18,P-19
PIEZOMETRIC ELEV. vs. TIME
EXHIBIT



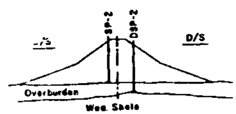
SP NO	STATION	OFFSET	PLATE EL	FORMATION	LEGEND
FILL	38+70			EMB FILL	———
SP-1	38+70	17 D/S	472 271	CLAY OVB(NC)	- - - - -
DSP-1	38+50	17 D/S	443.800	CLAY LAYER	— — —



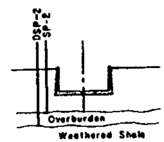
JOE POOL LAKE
FORT WORTH DISTRICT
FILL/SETTLEMENT PLATES
SP-1,DSP-1
SETTLEMENT vs. TIME
EXHIBIT



SP NO	STATION	OFFSET	PLATE EL	FORMATION	LEGEND
FILL	99+50			EMB FILL	———
SP-2	99+50	15 U/S	526 250	CLAY OVB(NC)	- - - - -
DSP-2	99+50	31 D/S	517 300	CLAY SHALE(WEA)	———

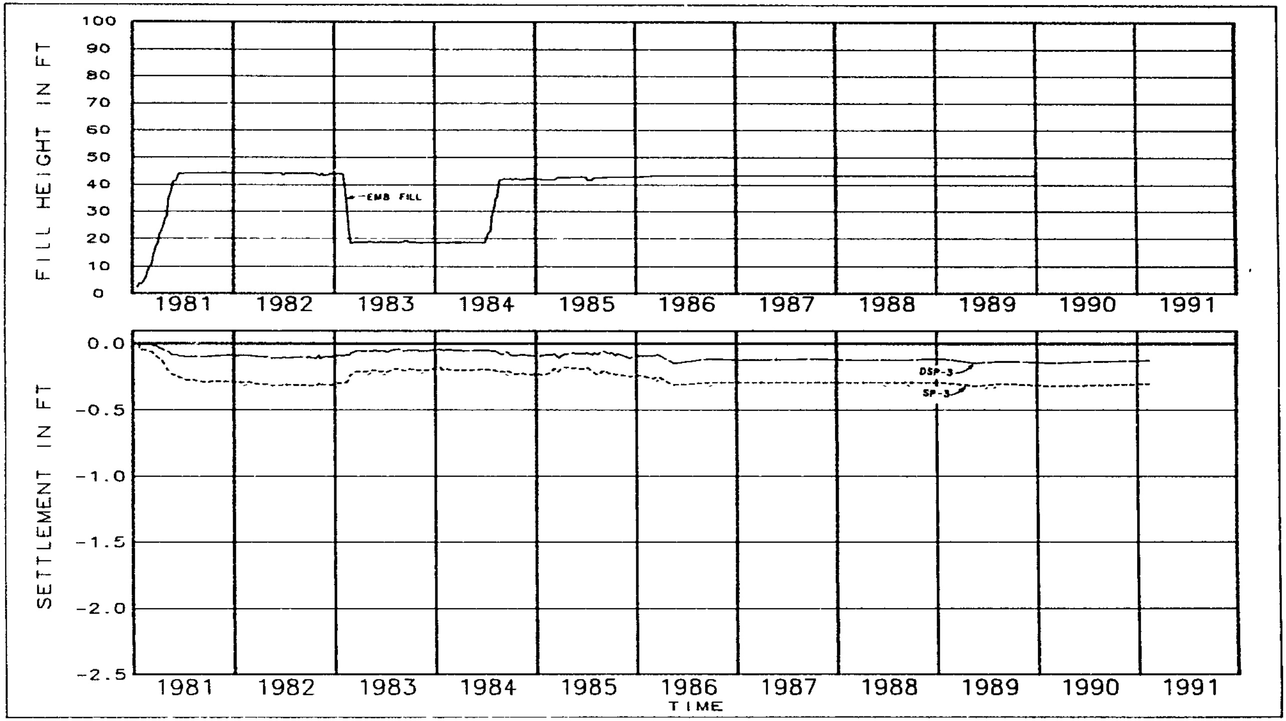


DETAIL #1

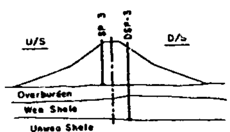


DETAIL #2

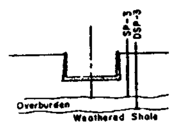
JOE POOL LAKE
FORT WORTH DISTRICT
FILL/SETTLEMENT PLATES
SP-2, DSP-2
SETTLEMENT vs. TIME
EXHIBIT



SP NO	STATION	OFFSET	PLATE EL	FORMATION	LEGEND
FILL	100+50			EMB FILL	————
SP-3	100+50	17 U/S	526 037	CLAY OVB(NC)	- - - - - -
DSP-3	100+50	29 D/S	493.700	CLAY SHALE	—— ——

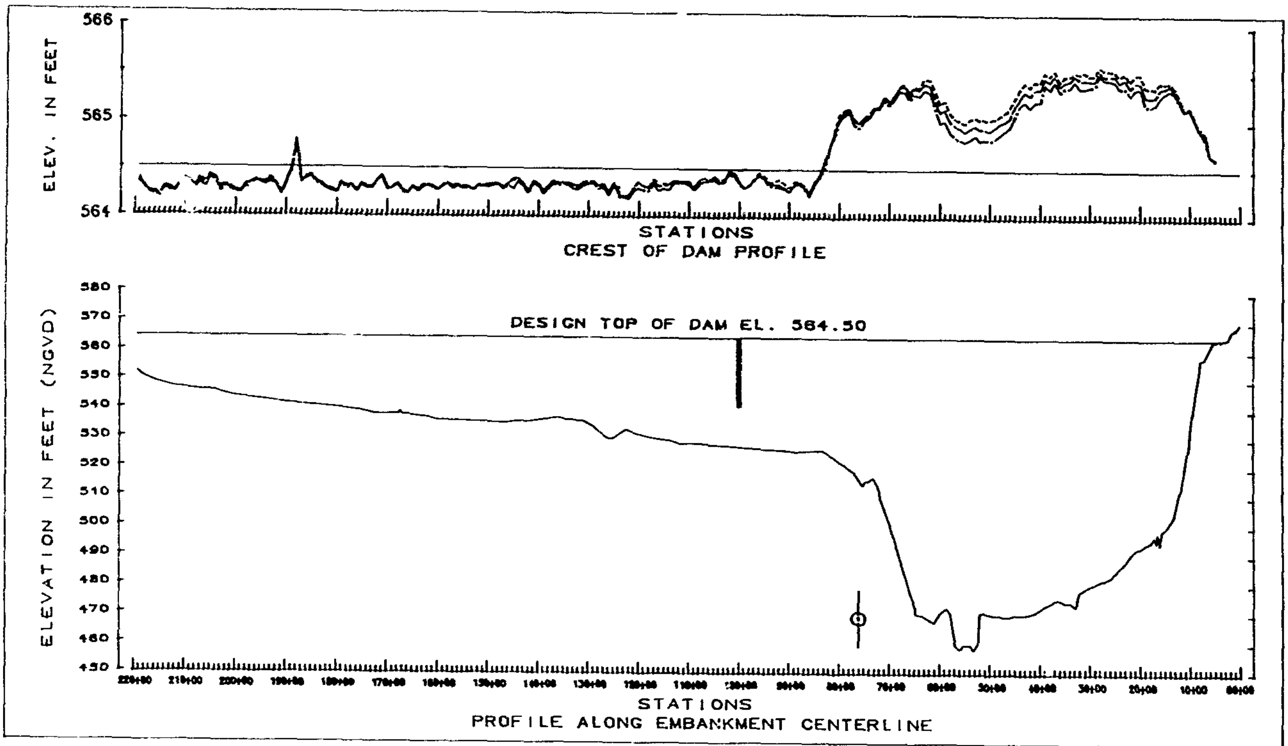


DETAIL #1



DETAIL #2

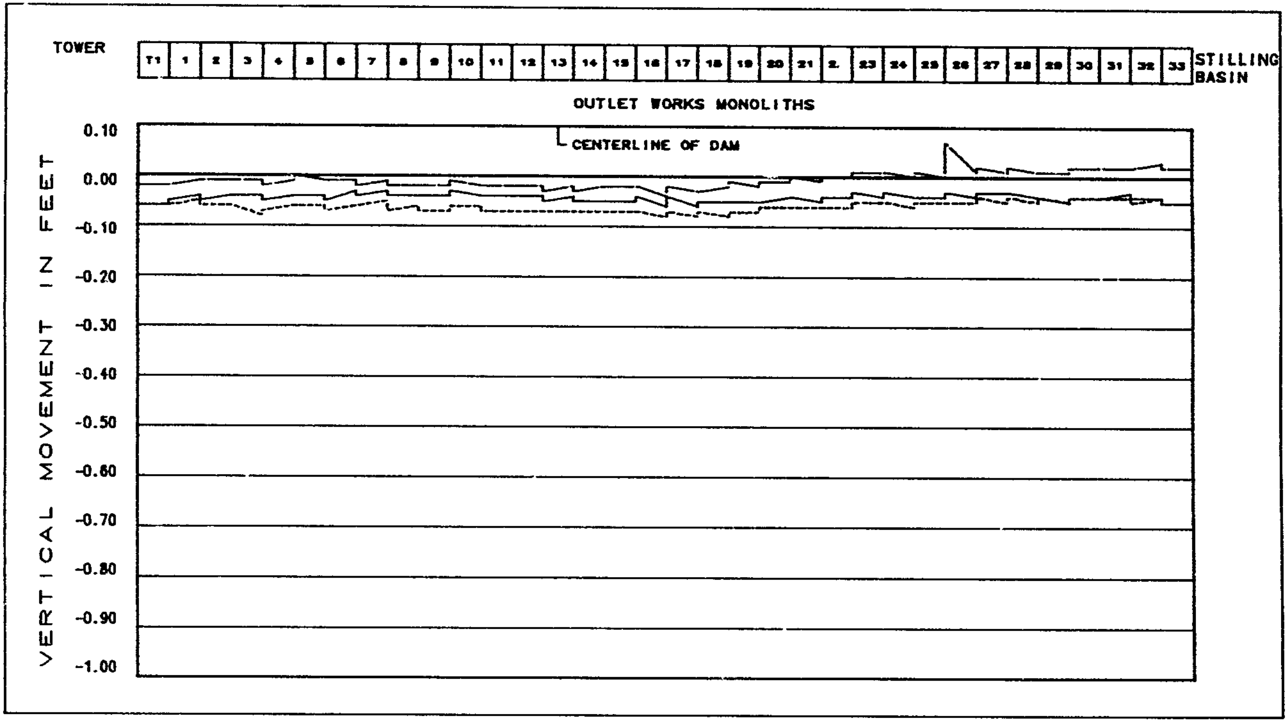
JOE POOL LAKE
FORT WORTH DISTRICT
FILL/SETTLEMENT PLATES
SP-3,DSP-3
SETTLEMENT vs. TIME
EXHIBIT



DATE OF SURVEY	LEGEND
15FEB87 CENTERLINE	------------
15DEC87 CENTERLINE	————————
15JAN89 CENTERLINE	——·——·—

NOTE: Survey rods for crest of dam are located approximately 15' downstream of the embankment centerline.

JOE POOL LAKE
FORT WORTH DISTRICT
CREST OF DAM PROFILE
EXHIBIT



DATE OF SURVEY	LEGEND
01JUL85	——————
15FEB88	----------
15FEB91	—— ——

NOTES:

INITIAL SURVEY TAKEN 15SEP84

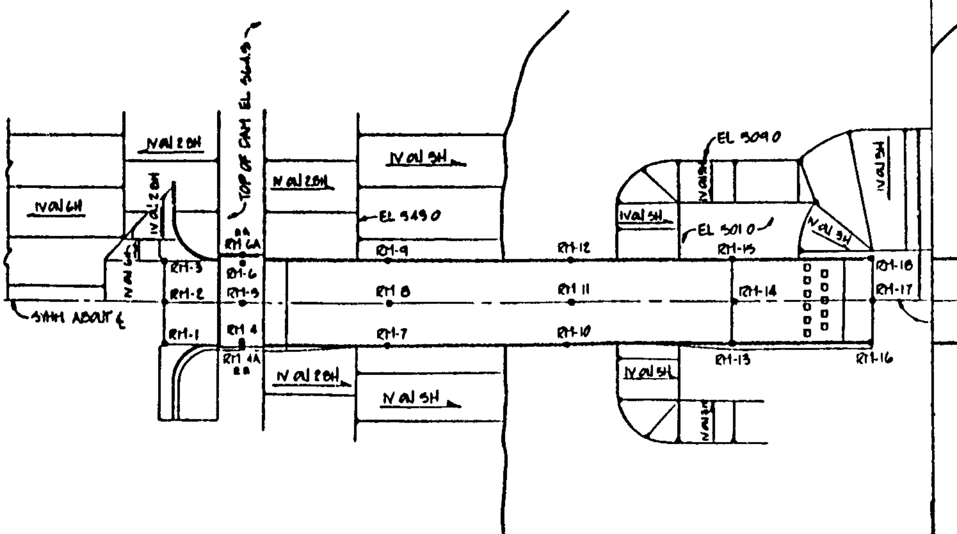
INITIAL SURVEY SET AS "0" BASELINE. ALL SUBSEQUENT MOVEMENT PLOTTED RELATIVE TO INITIAL READING.

JOE POOL LAKE
FORT WORTH DISTRICT
OUTLET WORKS
REFERENCE MARKS
VERTICAL MOVEMENT vs. TIME
EXHIBIT

CORPS OF ENGINEERS

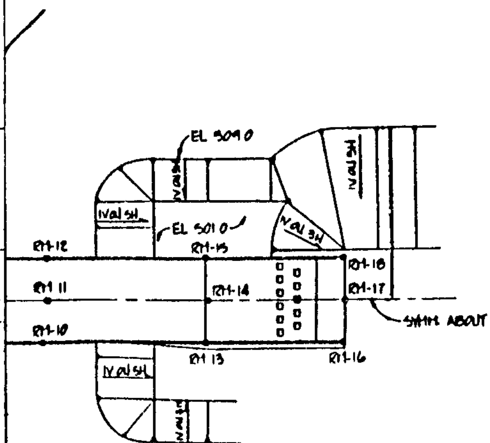
Change From Original Elevation: (+) Heave (-) Settlement

Original Elev.	540.92 6/28/85	540.97 6/28/85	540.95 6/28/85	540.88 6/28/85	540.83 6/28/85	540.91 6/28/85	541.52 6/28/85	528.20 6/28/85	541.53 6/28/85	517.63 6/28/85	504.31 6/28/85	517.53 6/28/85	503.99 6/28/85	.20 8/8
Date	RM-1	RM-2	RM-3	RM-4	RM-5	RM-6	RM-7	RM-8	RM-9	RM-10	RM-11	RM-12	RM-13	-8
Feb 86	+.02	+.02	+.02	+.02	-.02	+.02	.00	+.06	+.02	+.03	+.04	+.08	+.06	06
Sep 86	.00	+.01	+.02	+.01	+.01	+.01	+.02	+.06	+.02	+.04	+.09	+.06	+.04	06
Feb 87	+.01	+.02	+.01	+.01	+.02	+.01	+.04	+.07	+.05	+.05	+.10	+.07	+.07	07
Sep 87	.00	+.02	.00	+.01	+.01	+.01	+.04	+.07	+.04	+.06	+.10	+.07	+.07	07
Feb 88	-.01	.00	-.02	-.01	-.01	.00	+.04	+.05	+.04	+.03	+.05	+.05	+.03	05
Aug 89	0	+ 01	- 01	+ 01	+ 01	+ 01	+ 07	+ 10	+ 05	- 09	+ 11	+ 10	*	10
Feb 90	- 01	0	- 02	0	0	0	+ 06	+ 11	+ 05	+ 07	+ 12	+ 09	*	11
Feb 91	0	+ 01	- 01	+ 01	+ 02	0	+ 08	+ 11	+ 06	+ 06	+ 11	+ 10	+ 04	11



US ARMY

.20	541.53	517.63	504.31	517.53	503.99	Underwater	504.01	503.98	Underwater	504.02
5/8/85	6/28/85	6/28/85	6/28/85	6/28/85	6/28/85	6/28/85	6/28/85	6/28/85	6/28/85	6/28/85
-8	RM-9	RM-10	RM-11	RM-12	RM-13	RM-14	RM-15	RM-16	RM-17	RM-18
06	+.02	+.03	+.04	+.08	+.06	Underwater	+.07	+.07	Underwater	+.06
06	+.02	+.04	+.09	+.06	+.04	Underwater	+.06	+.05	Underwater	+.06
07	+.05	+.05	+.10	+.07	+.07	Underwater	+.07	+.07	Underwater	+.07
07	+.04	+.06	+.10	+.07	+.07	Underwater	+.07	+.07	Underwater	+.07
05	+.04	+.03	+.05	+.05	+.03	Underwater	+.06	+.03	Underwater	+.06
10	+ 05	+ 09	+ 11	+ 10	*	Underwater	*	*	Underwater	*
11	+ 05	+ 07	+ 12	+ 09	*	Underwater	*	*	Underwater	*
11	+ 06	+ 06	+ 11	+ 10	+ 04	Underwater	+ 08	*	Underwater	*



Original Elev Date	564 48 Feb 88 RM-4A	564 46 Feb 88 RM-6A
Feb 88	0	0
Sep 88	0	0
Jan 89	0	+ 01
Aug 89	- 01	0
Feb 90	- 03	02
Feb 91	0	0

JOE POOL LAKE
MOUNTAIN CREEK LAKE

SPILLWAY
REFERENCE MARKS

US ARMY ENGINEER DISTRICT, FT WORTH

PLATE

CORPS OF ENGINEERS

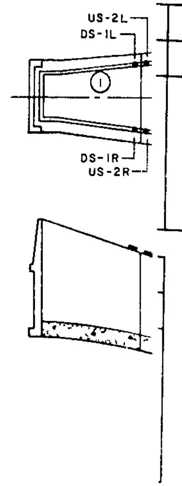
VERTICAL MOVEMENT IN FEET LEFT WALL						
DATE	DS-1L	US-2L	DS-2L	US-3L	DS-3L	US-4L
ORIGINAL ELEV. APRIL 86	478.79	478.48	472.15	472.16	472.14	472.15
Sep 86	00	00	- 01	- 01	- 02	- 01
Feb 87	- 01	- 02	- 01	- 01	- 02	- 01
Sep 87	- 01	- 02	00	00	- 01	- 01
Feb 88	- 05	- 04	- 04	- 04	- 06	- 05
Jan 89	- 03	- 03	- 03	- 03	- 04	- 03
Aug 89	+ 01	.00	+ 02	+ 01	+ 01	+ 01
Feb 90	00	+ 01	- 01	- 01	- 03	- 02
Feb 91	00	00	+ 01	00	00	+ 01

DATE	DS-4L	US-5L	DS-5L	US-6L	DS-6L
ORIGINAL ELEV. April 86	472.16	472.15	472.16	472.15	472.17
Sep 86	- 01	- 01	- 01	- 02	- 02
Feb 87	00	- 01	- 01	- 01	- 01
Sep 87	00	00	00	- 01	- 02
Feb 88	- 04	- 05	- 05	- 05	-.05
Jan 89	- 02	- 03	- 02	- 03	- 02
Aug 89	+ 03	+ 02	+ 02	+ 01	+ 02
Feb 90	00	- 01	00	- 01	- 01
Feb 91	+ 02	+ 01	+ 02	+ 01	+ 01

VERTICAL MOVEMENT IN FEET RIGHT WALL						
DATE	DS-1R	US-2R	DS-2R	US-3R	DS-3R	US-4R
ORIGINAL ELEV. April 86	478.75	478.47	472.15	472.15	472 15	472.16
Sep 86	00	+ 01	- 02	- 02	- 01	02
Feb 87	00	- 01	- 01	- 01	00	- 01
Sep 87	01	- 02	01	- 01	01	- 01
Feb 88	- 04	- 04	- 05	- 05	- 04	- 05
Jan 89	- 02	- 02	- 03	- 03	- 02	- 03
Aug 89	+ 02	+ 01	+ 01	00	+ 01	00
Feb 90	+ 01	+ 02	00	- 01	+ 01	00
Feb 91	+ 01	+ 01	00	00	+ 01	00

DATE	DS-4R	US-5R	DS-5R	US-6R	DS-6R
ORIGINAL ELEV April 86	472.15	472.15	472.14	472.14	472 16
Sep 86	- 02	- 02	- 01	- 02	- 02
Feb 87	- 01	- 02	- 01	- 02	- 01
Sep 87	01	- 01	00	- 01	- 01
Feb 88	- 05	- 06	04	05	- 05
Jan 89	- 03	- 03	- 02	- 03	03
Aug 89	+ 01	00	+ 01	00	00
Feb 90	+ 01	00	+ 01	00	00
Feb 91	+ 01	00	+ 01	+ 01	01

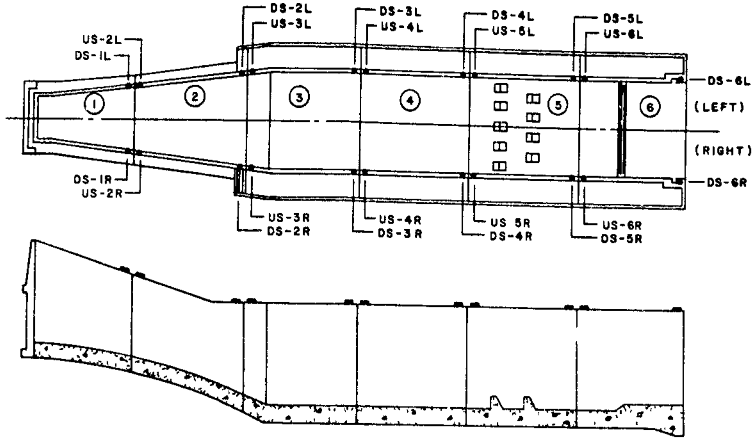
(+) = heave (-) = settlement



US ARMY

US-4L
472.15
-01
-01
-01
-05
-03
+01
-02
+01

US-4R
472.16
-02
-01
-01
-05
-03
00
00
00



JOE POOL LAKE
STILLING BASIN REFERENCE MARKS
Outlet Works

US ARMY ENGINEER DISTRICT, FT WORTH

PLATE

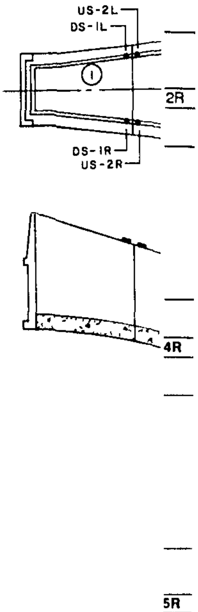
CORPS OF ENGINEERS

HORIZONTAL MOVEMENT (Distance Between Points)			
DATE	DS-1L TO DS-1R	US-2L TO US-2R	DS-2L TO DS-2R
ORIGINAL DIST April 86	16 25'	16 47'	23 67'
Sep 86	16 24'	16 46'	23 67'
Feb 87	16 24'	16 47'	23 67'
Sep 87	16 24'	16 47'	23 67'
Feb 88	16 24'	16 46'	23 67'
Jan 89	16 23'	16 45	23 66'
Aug 89	16 25'	16 47'	23 68'
Feb 90	16 24'	16 46'	23 66'
Feb 91	16 24'	16 46'	23 66'

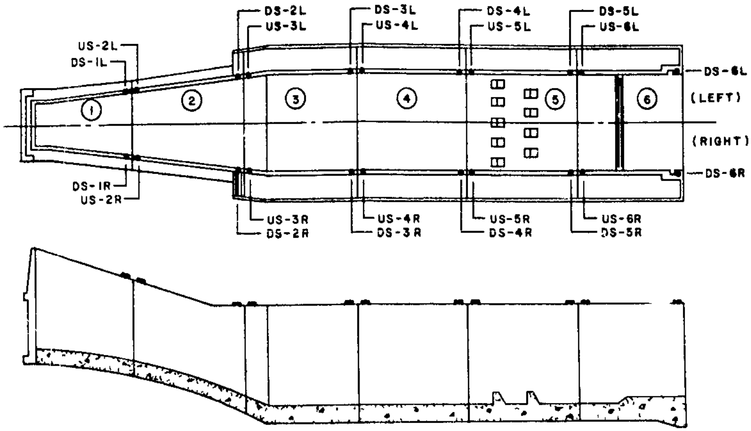
DATE	US-3L TO US-3R	DS-3L TO DS-3R	US-4L TO US-4R
ORIGINAL DIST. April 86	23 93'	25.23'	25.26'
Sep 86	23 93'	25 23'	25 25'
Feb 87	23 93'	25 23'	25 26'
Sep 87	23 94'	25 23'	25 26'
Feb 88	23 92'	25 22'	25 25'
Jan 89	23 92'	25 22'	25 25'
Aug 89	23 94'	25 24'	25 27'
Feb 90	23 93'	25 22'	25 25'
Feb 91	23 92'	25 22'	25 25'

DATE	DS-4L TO DS 4R	US-5L TO US-5R	DS-5L TO DS-5R
ORIGINAL DIST. April 86	25 36'	25 37'	25 39'
Sep 86	25 36'	25 37'	25 39'
Feb 87	25 37'	25 38'	25 40'
Sep 87	25 36	25 37'	25 39'
Feb 88	25 36'	25 37'	25 39'
Jan 89	25 36'	25 38'	25 39'
Aug 89	25 37'	25 38'	25 39'
Feb 90	25 36	25 37'	25 39'
Feb 91	25 36'	25 36'	25 29'

DATE	US-6L TO US-6R	DS-6L TO DS-6R
ORIGINAL DIST April 86	25 40'	25.29'
Sep 86	25 40'	25 30'
Feb 87	25 40'	25 29'
Sep 87	25 40'	25 29'
Feb 88	25 40'	25 28'
Jan 89	25 40'	25 29'
Aug 89	25 40'	25 29'
Feb 90	25 40'	25 29'
Feb 91	25 40'	25 29'

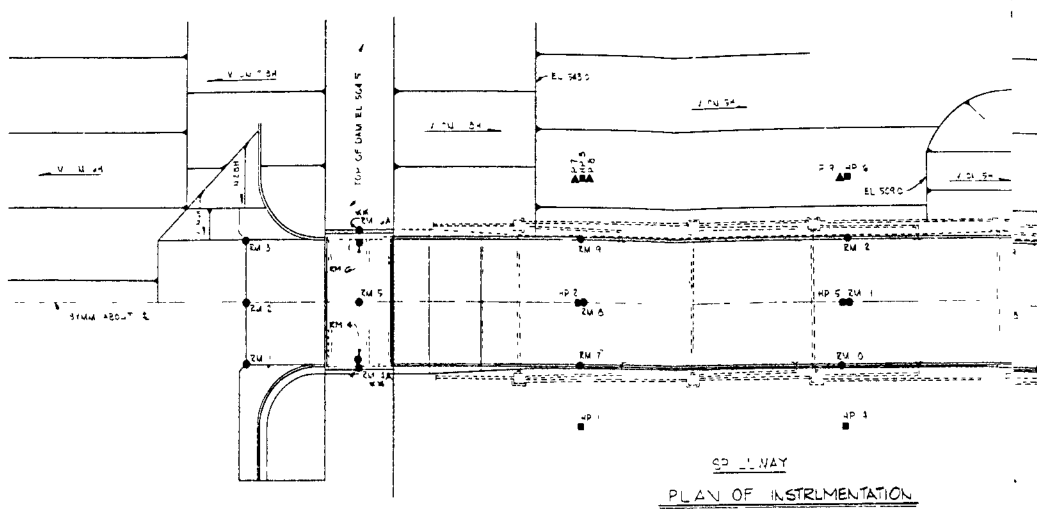


U.S. ARMY



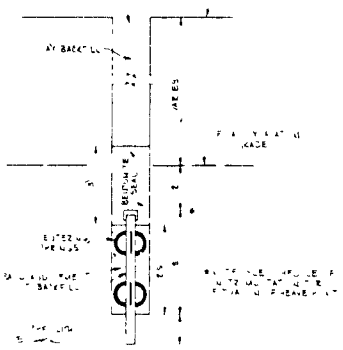
JOE POOL LAKE
STILLING BASIN WALL REFERENCE MARKS
Outlet Works

US ARMY ENGINEER DISTRICT, FT WORTH



SPILLWAY

PLAN OF INSTRUMENTATION



HEAVE POINT DETAIL

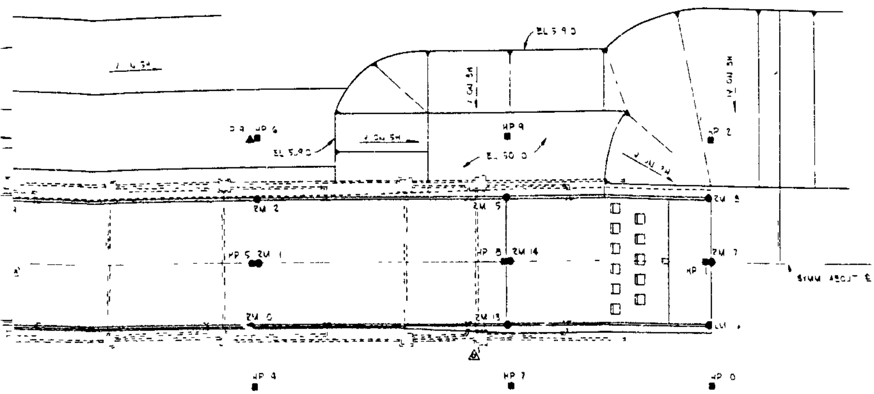
HEAVE POINT			
NO	STATION	OFFSET	APPROX EL
HP 1	0+45	50 R	523
HP 2	0+45	℄	[illegible]
HP 3	0+45	50 L	[illegible]
HP 4	2+[illegible]5	50 R	499
HP 5	2+[illegible]5	℄	499
HP 6	[illegible]	[illegible]	499
HP 7	3+[illegible]	50 R	[illegible]
HP 8	3+[illegible]	℄	[illegible]
HP 9	3+2[illegible]	50 L	[illegible]
HP 10	4+[illegible]	50 R	477
HP 11	4+[illegible]	℄	477
HP 12	4+[illegible]	50 L	477

REFERENCE MARK			
NO	STATION	OFFSET	LOCATION
RM 1	1+56	14 R	TOP OF APPROACH SLAB
RM 2	1+56	℄	℄ APPROACH SLAB
RM 3	1+56	14	TOP OF APPROACH SLAB
RM 4	[illegible]	14 R	TOP OF [illegible] SLAB [illegible]
RM 5	[illegible]	℄	℄ [illegible] SLAB
RM 6	[illegible]	14	TOP OF [illegible] SLAB [illegible] FROM LEFT WALL
RM 7	[illegible]45	25.87 R	TOP OF RIGHT WALL
RM 8	[illegible]45	℄	℄ CHUTE SLAB
RM 9	0+45	25.87 L	TOP OF LEFT WALL
RM 10	2+[illegible]5	25.87 R	TOP OF RIGHT WALL
RM 11	2+[illegible]	℄	℄ CHUTE SLAB
RM 12	2+[illegible]	25.87 L	TOP OF LEFT WALL
RM 13	[illegible]	25.87 R	TOP OF RIGHT WALL
RM 14	[illegible]	℄	℄ [illegible] SLAB
RM 15	[illegible]	25[illegible]	TOP OF LEFT WALL
RM 16	[illegible]	25.87 R	TOP OF RIGHT WALL
RM 17	4+[illegible]	℄	℄ STILLING BASIN SLAB
RM 18	4+[illegible]	25.87 L	TOP OF LEFT WALL
** RM 4A	0+00	25.7 R	[illegible] FROM EDGE OF APPROACH SLAB
** RM 5A	0+00	25.7 L	[illegible] FROM EDGE OF APPROACH SLAB

** [illegible] BRONZE BOLTS REQD. ETCH REF MARKS INTO BRIDGE APPROACH SLAB ARMORED JOINT ANGLES

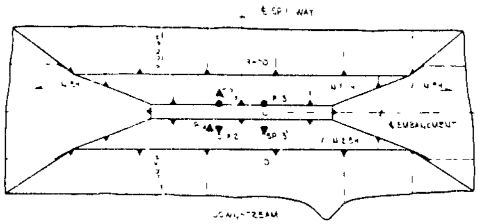
NOTES
ALL STA [illegible]
SP[illegible]
2 SEE SE[illegible]
3 SEE [illegible]
4 SEE [illegible]

INSTRUMENTATION SCHEDULE



SPILLWAY

PLAN OF INSTRUMENTATION



LEFT EMBANKMENT NO 2

PLAN OF EXISTING INSTRUMENTATION

REFERENCE MARK

NO.	STATION	OFFSET	LOCATION
ZM	[illegible]	4 Z	[illegible] PORTAL SLAB
RM 2	[illegible]	℄	℄ APPROACH SLAB
ZM 3	[illegible]	4	[illegible] APPROACH SLAB
ZM 4	[illegible]	4 Z	[illegible]
RM 5	[illegible]	℄	[illegible]
ZM	[illegible]	4	[illegible]
RM	45	25 Z	[illegible] WALL
ZM	47	℄	[illegible] SLAB
ZM	5	25	[illegible]
RM	[illegible]	25 Z	[illegible] WALL
ZM	5	℄	℄ [illegible]
ZM	[illegible]	[illegible]	[illegible] LEFT WALL
RM	[illegible]	25 Z	[illegible] RIGHT WALL
RM	5	℄	℄ [illegible] SLAB
ZM	5	25	[illegible] WALL
RM	29	25 Z	[illegible] WALL
ZM	29	℄	℄ [illegible] SLAB
ZM	4+09	[illegible]	[illegible] WALL
RM [illegible]	0 00	25 Z	[illegible] APPROACH SLAB
RM [illegible]	0 00	25 [illegible]	[illegible] APPROACH SLAB

[illegible] BRONZE BOLTS [illegible] REF MARKS INTO BRIDGE APPROACH SLAB ARMORED JOINT ANGLES

NOTES

1. ALL STATIONS GIVEN ON THE [illegible] ARE SPILLWAY STATIONS
2. SEE SEQ [illegible] FOR SECTION THROUGH PIEZOMETERS
3. SEE [illegible] FOR LEGEND
4. SEE [illegible] AND [illegible] FOR [illegible] DETAILS

POROUS PLASTIC TIP PIEZOMETER

NO.	STATION	OFFSET	[illegible]	[illegible]	LOCATION
P 7	[illegible]	50 [illegible]			[illegible]
P 8	[illegible]	50 [illegible]	[illegible]		[illegible]
P 9	[illegible] 5	50 [illegible]	[illegible]		[illegible]

[illegible] DETERMINED AT THE TIME [illegible]

INSTRUMENTATION SCHEDULE

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

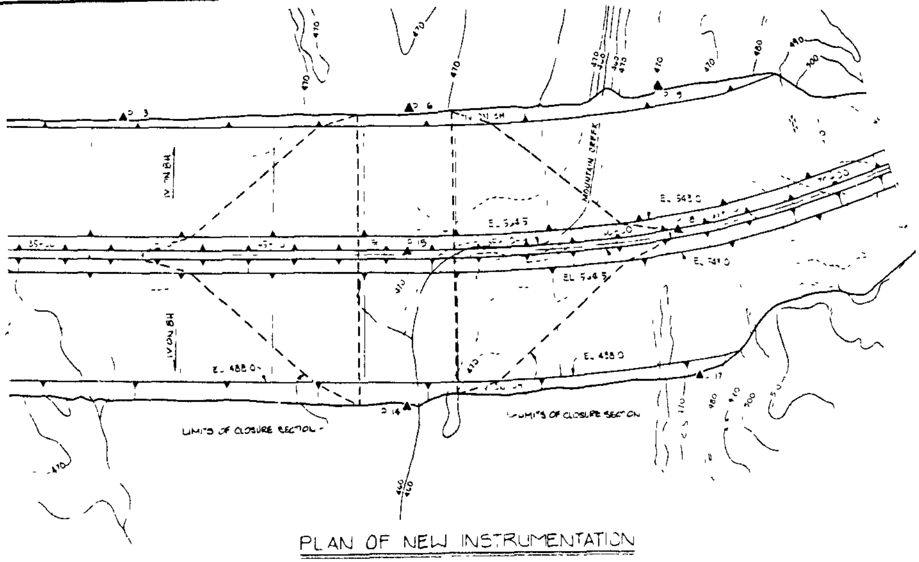
JOE POOL LAKE

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

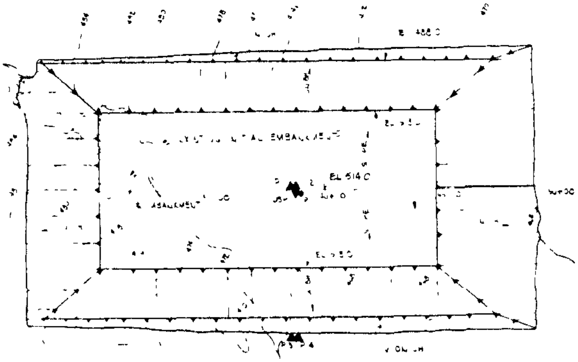
INSTRUMENTATION PLAN

LEFT EMBANKMENT NO 2 AND SPILLWAY

SEQUENCE NO 22



PLAN OF NEW INSTRUMENTATION



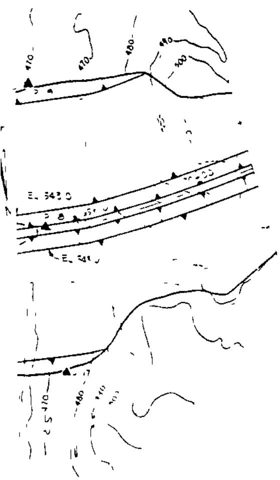
PLAN OF EXISTING INSTRUMENTATION

SCALE IN FEET

SCHEDULE OF INSTRUMENTATION

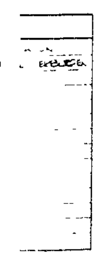
NO.	STATION	OFFSET	FILTER ELEVATION*		REMARKS	LOCATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	434	[illegible]		
[illegible]	[illegible]	[illegible]	433	[illegible]		
[illegible]	[illegible]	[illegible]	431	435		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	433	[illegible]		

* [illegible] PIEZOMETER FILTER ELEVATION SHOWN ARE APPROXIMATE. ACTUAL ELEVATIONS WILL BE DETERMINED AT TIME OF INSTALLATION.



LEGEND

P-1 ▲ PIEZOMETER
SP-1 ● SETTLEMENT PLATE
DSP ▼ DEEP SETTLEMENT PLATE
HP- ■ HEAVE POINT
RM-1 ● REFERENCE MARK



U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

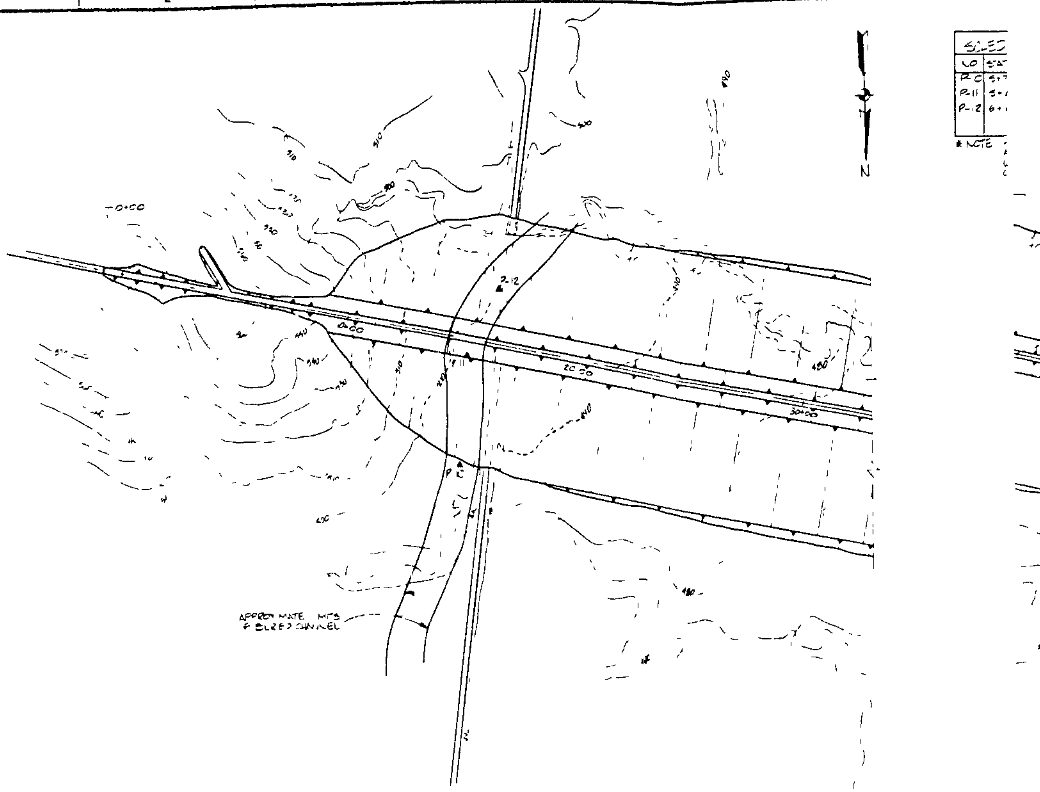
JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

FLOODPLAIN EMBANKMENT INSTRUMENTATION

DESIGNED BY
DRAWN BY
CHECKED BY
SUBMITTED BY
DATED
DRAWING NUMBER
SHEET NO
SEQUENCE NO 21

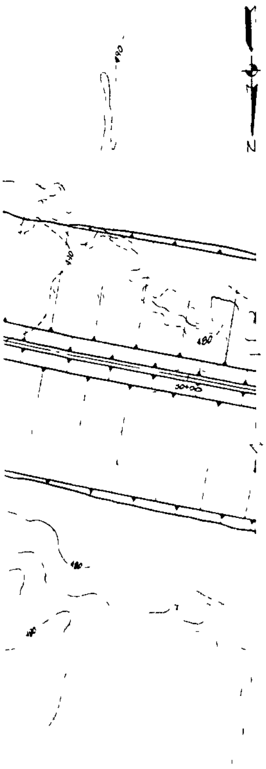
PLATE 99



PLAN

SCALE IN FEET

200 0 200 400



SCALE IN FEET

200 0 200 400

SCHEDULE OF INSTRUMENTATION

NO	STATION	OFFSET	FILTER ELEVATION *	REMARKS
P-10	5+70	500 D/S	440 - 444	LOCATED IN BURIED CHANNEL
P-11	15+25	70 D/S	440 - 444	
P-12	16+10	220 U/S	440 - 444	

* NOTE FILTER ELEVATIONS SHOWN ARE APPROXIMATE ACTUAL ELEVATIONS WILL BE DETERMINED AT TIME OF INSTALLATION.

NOTES

1 SEE SEQ 104 FOR SECTION THROUGH PIEZOMETERS

2 SEE SEQ 21 FOR LEGEND

3 SEE SEQ 23 AND 24 FOR NOTES AND DETAILS

U S ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH TEXAS

DESIGNED BY M SIMMONS
T SCHMIDT

DRAWN BY

CHECKED BY M SIMMONS

JOE POOL LAKE
MOUNTAIN CREEK TEXAS

EMBANKMENT, SPILLWAY, AND OUTLET WORKS

PLAN OF INSTRUMENTATION
BURIED CHANNEL AT RIGHT ABUTMENT

SUBMITTED BY R STROMAN

INV NO

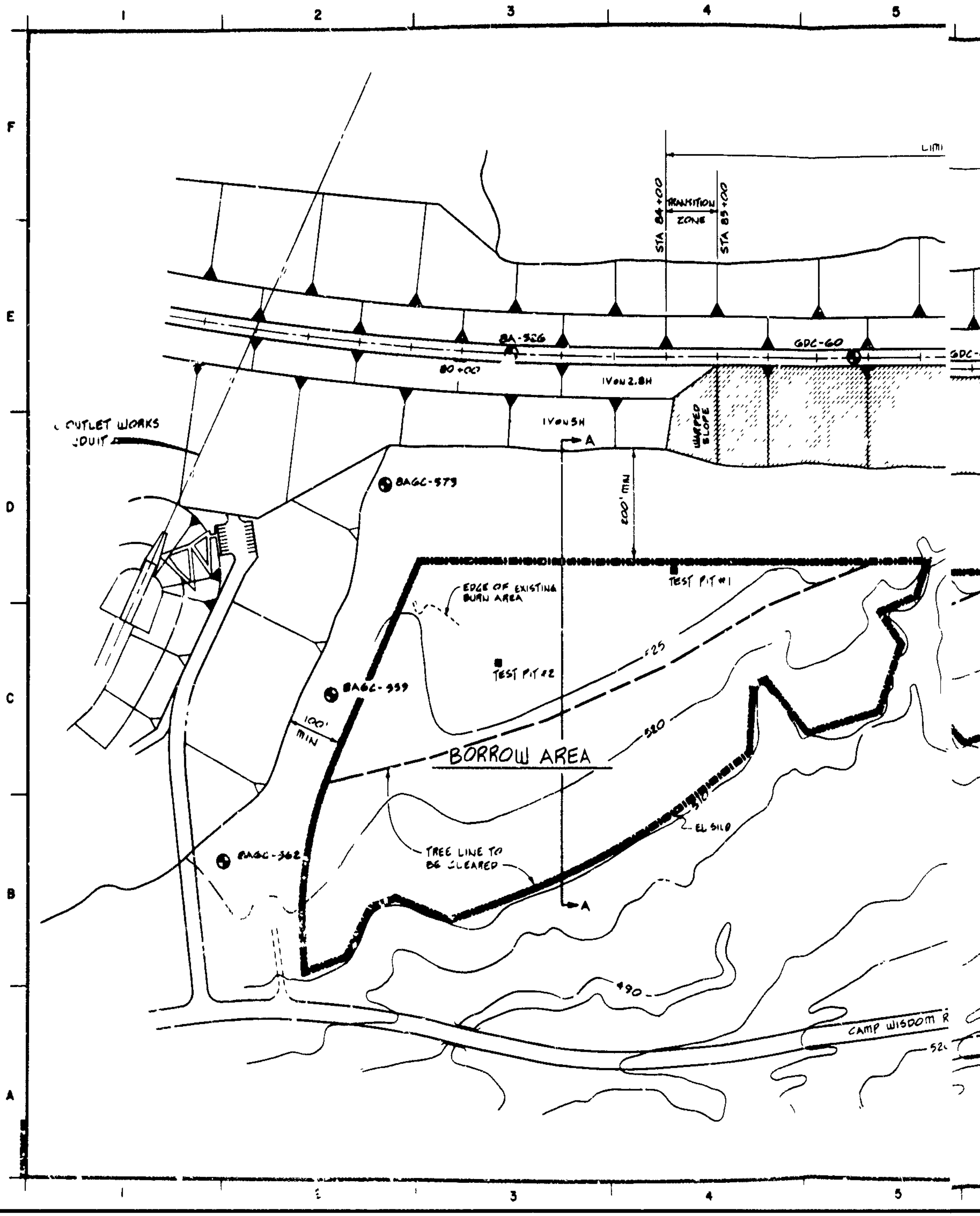
DATED

DRAWING NUMBER

SHEET NO

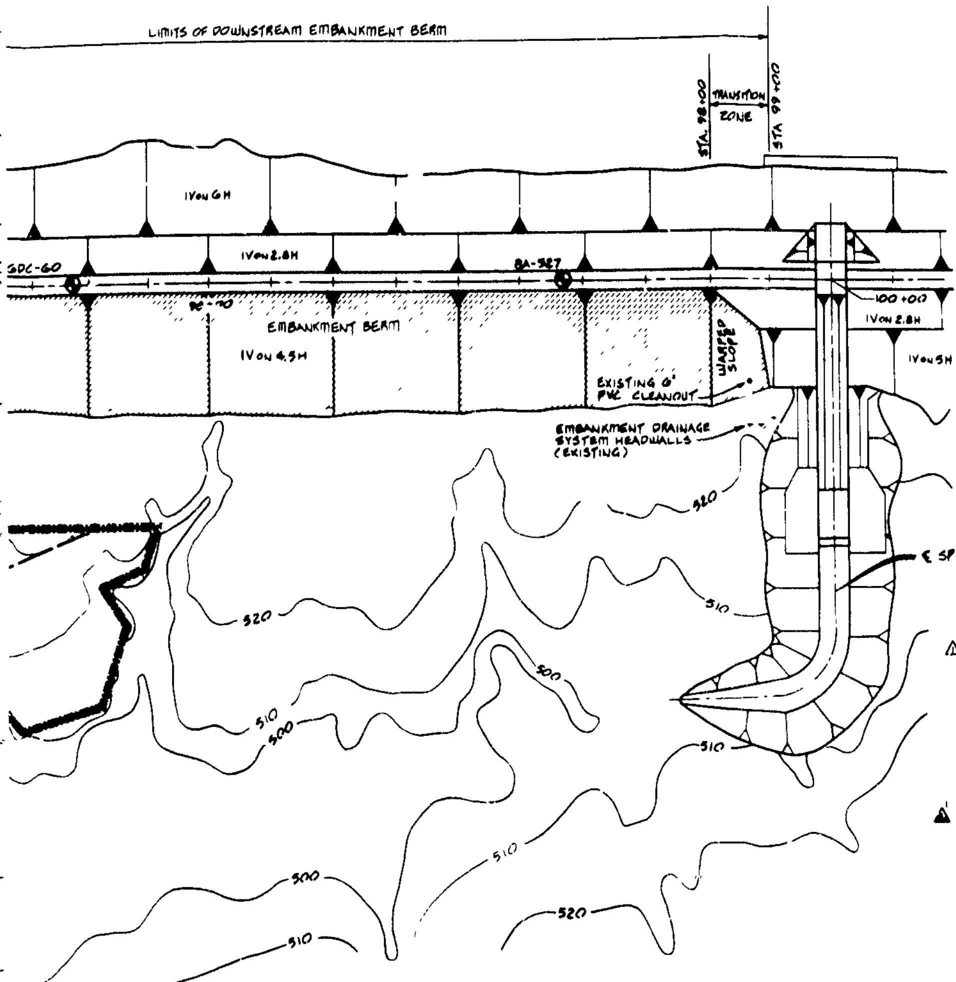
SEQUENCE NO 20

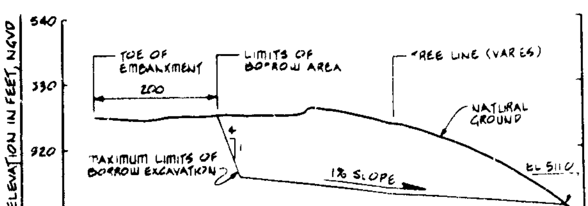
PLATE 100



STA 84+00
TRANSITION ZONE
STA 85+00
BA-526
GDC-60
80+00
1V on 2.8H
1V on 5H
WARPED SLOPE
OUTLET WORKS
A
BAGC-573
200' MIN
TEST PIT #1
EDGE OF EXISTING BURN AREA
TEST PIT #2
525
BAGC-559
100' MIN
BORROW AREA
520
EL 510
TREE LINE TO BE CLEARED
BAGC-362
490

5 6 7 8 9





SECTION A-A

NOTES

1 ALL DISTURBED AREAS ON THE RECEIVE MULCHING

2 ALL DISTURBED AREAS IN T RECEIVE MULCHING

3 ALL FINAL BORROW AREA SLOPES, SHALL NOT BE STE

4 BORROW EXCAVATION AREA

5 AT THE CONTRACTORS OPTIO AREA MAY BE UTILIZED AS AREA

6 THE EXISTING 6 INCH PV AND 155 FEET DOWNSTR DRAINAGE SYSTEM HEA BY THE CONTRACTOR I REPAIRED BY THE CONT GOVERNMENT.

100 0

SCALE IN

DESIGNED BY: C. SANCHEZ

DRAWN BY: R.L. HILL

CHECKED BY: J. WISE

SUBMITTED BY: H.E. KARBS P.E.

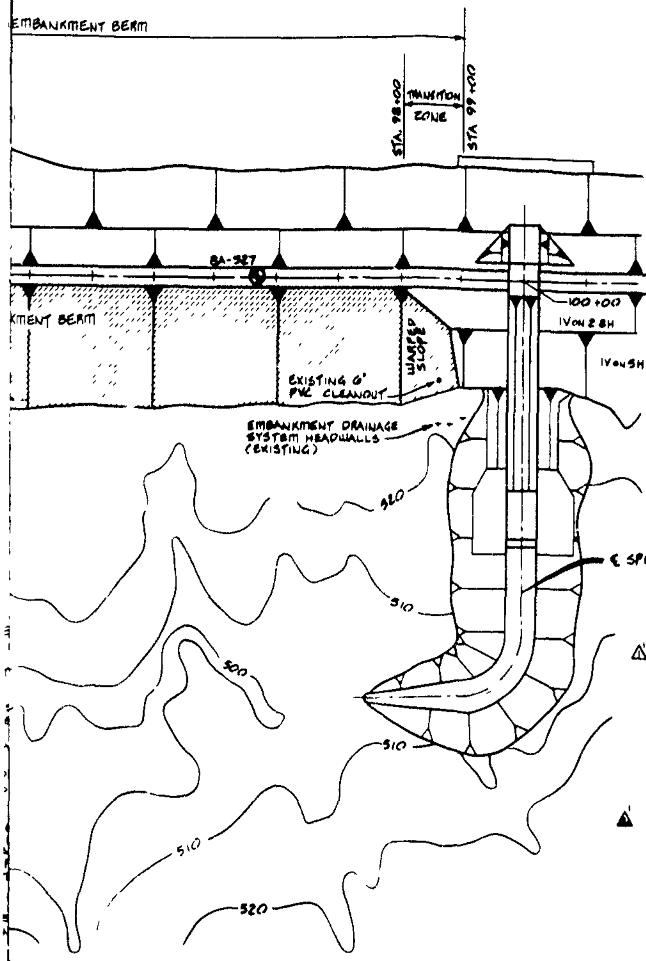
MOU

EMBAN

BERM

ELEVATION IN FEET, NGVD

5 6 7 8

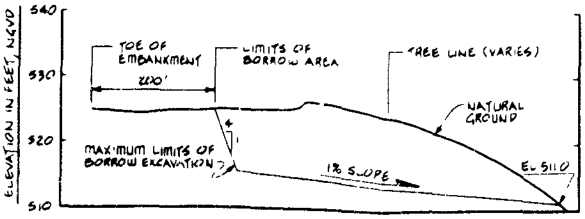


NOTES.

1. ALL DISTURBED AREAS ON THE EMBANKMENT SHALL RECEIVE MULCHING
2. ALL DISTURBED AREAS IN THE BORROW AREA SHALL RECEIVE MULCHING
3. ALL FINAL BORROW AREA SLOPES, INCLUDING SIDE SLOPES, SHALL NOT BE STEEPER THAN 1V ON 4 H.
4. BORROW EXCAVATION AREAS TO DRAIN AT ALL TIMES
5. AT THE CONTRACTORS OPTION, A PORTION OF THE BORROW AREA MAY BE UTILIZED AS DESIGNATED WASTE DISPOSAL AREA
6. THE EXISTING 6 INCH PVC CLEANOUT STATION 98+65 AND 155 FEET DOWNSTREAM AND THE EMBANKMENT DRAINAGE SYSTEM HEADWALLS SHALL BE PROTECTED BY THE CONTRACTOR. IF DAMAGED THEY SHALL BE REPAIRED BY THE CONTRACTOR AT NO COST TO THE GOVERNMENT.

100 0 100 200

SCALE IN FEET



SECTION A-A

1	DACW63-89-0001		DELETED TURFING & ADDED MULCHING
SYMBOL		DATE	DESCRIPTION OF CHANGE

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

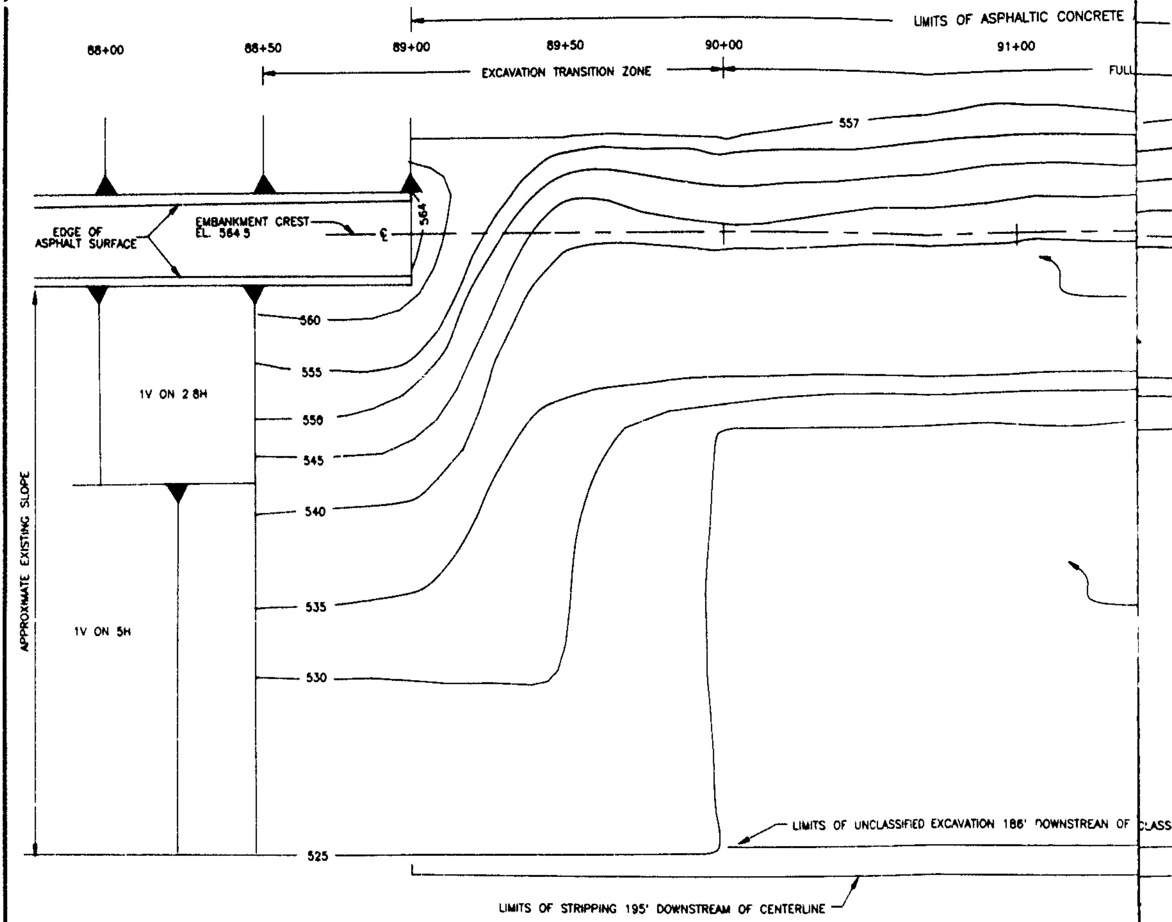
DESIGNED BY: C. SANCHEZ
DRAWN BY: R.L. HILL
CHECKED BY: J. WISE

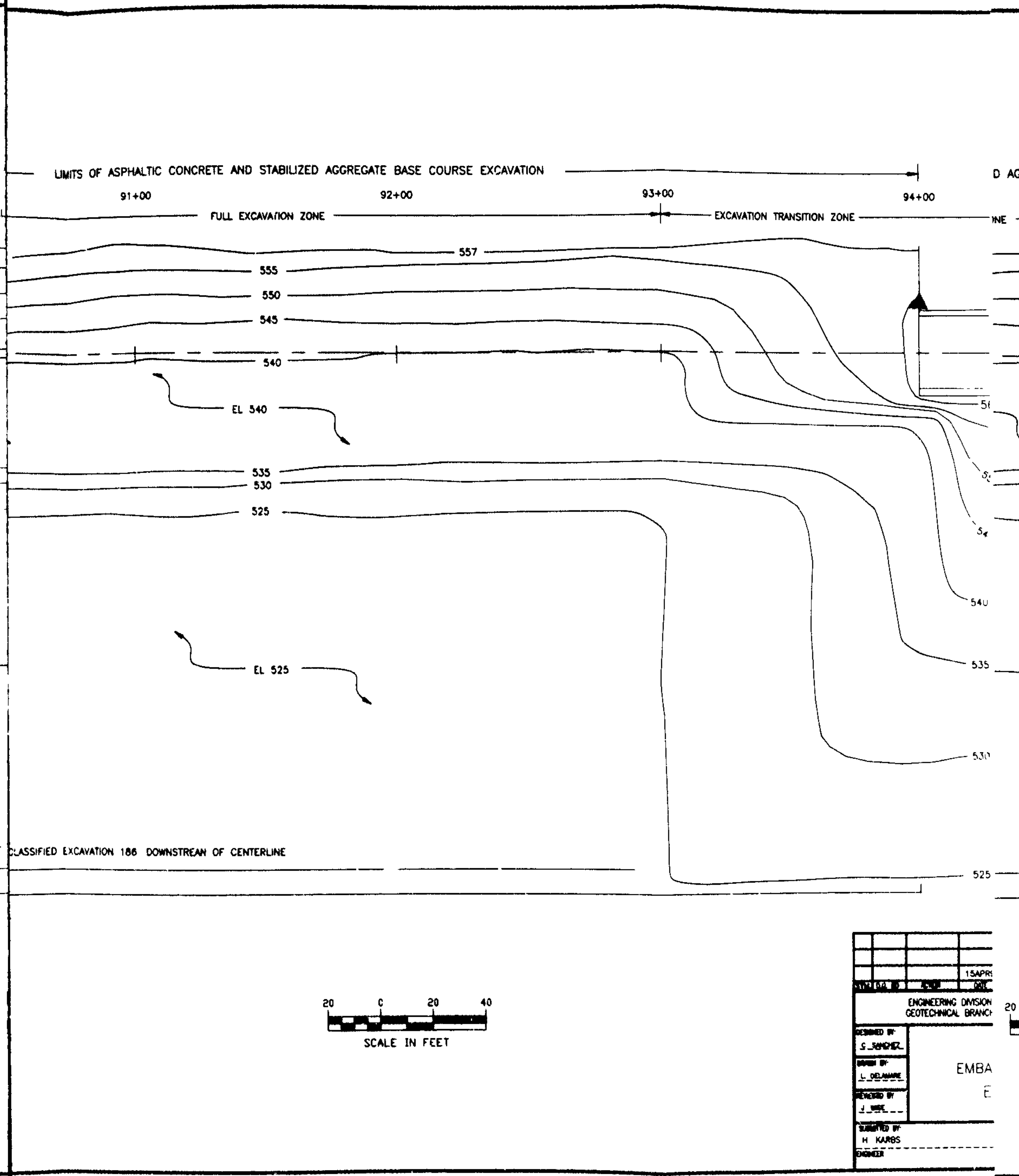
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS
EMBANKMENT SLIDE REPAIR
BERM AND BORROW AREA

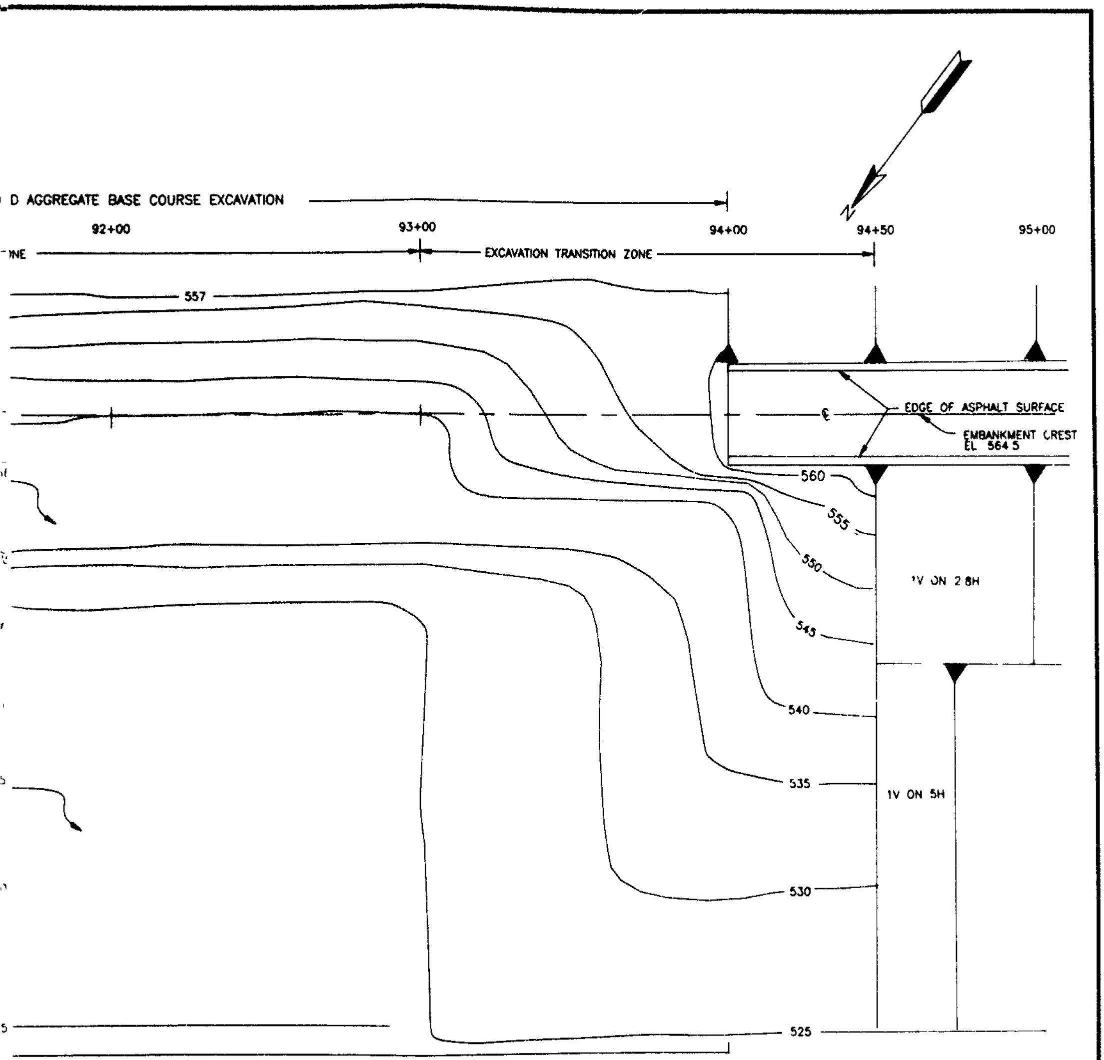
SUBMITTED BY: H.E. KARGS P.E.

SOL. No DACW63-89-B-0097 DATE JAN 1989
CONTRACT No. DACW63 89 C 0058
SHEET No. 2

PLATE 101


LIMITS OF ASPHALTIC CONCRETE
88+00
88+50
89+00
89+50
90+00
91+00
EXCAVATION TRANSITION ZONE
FULL
557
EDGE OF ASPHALT SURFACE
EMBANKMENT CREST EL. 564.5
564
560
555
550
545
540
535
530
525
1V ON 2.8H
1V ON 5H
APPROXIMATE EXISTING SLOPE
LIMITS OF UNCLASSIFIED EXCAVATION 186' DOWNSTREAM OF CLASS
LIMITS OF STRIPPING 195' DOWNSTREAM OF CENTERLINE

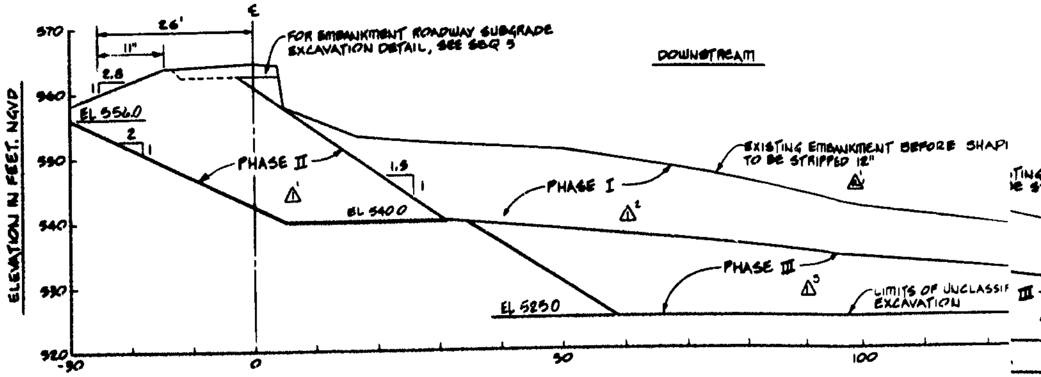

LIMITS OF ASPHALTIC CONCRETE AND STABILIZED AGGREGATE BASE COURSE EXCAVATION
91+00
92+00
93+00
94+00
FULL EXCAVATION ZONE
EXCAVATION TRANSITION ZONE
557
555
550
545
540
EL 540
535
530
525
EL 525
CLASSIFIED EXCAVATION 186 DOWNSTREAM OF CENTERLINE
20 0 20 40
SCALE IN FEET
ENGINEERING DIVISION
GEOTECHNICAL BRANCH
DESIGNED BY
C. SANCHEZ
DRAWN BY
L. DELAWARE
REVIEWED BY
J. WISE
SUBMITTED BY
H. KARBS
ENGINEER
EMBA



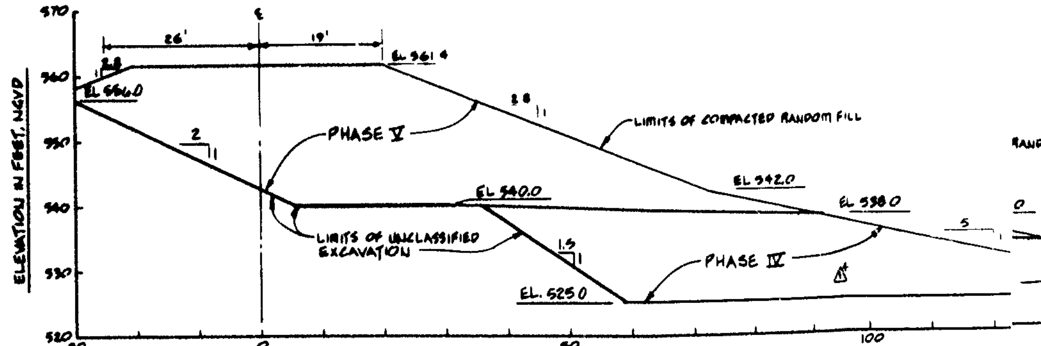
SCALE IN FEET

15APR91	ASBUILT	
ENGINEERING DIVISION GEOTECHNICAL BRANCH		U S ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS
DESIGNED BY: S. SANCHEZ	JOE POOL LAKE MOUNTAIN CREEK LAKE	
DRAWN BY: L. DELAMARE	EMBANKMENT SLIDE REPAIR	
REVIEWED BY: J. WISE	EXCAVATION PLAN	
SUBMITTED BY: H KARBS	INVITATION NO	DATE
ENGINEER	CONTRACT NO.	SEQUENCE NO
	DRAWING NUMBER	SHEET NO OF

PLATE 102



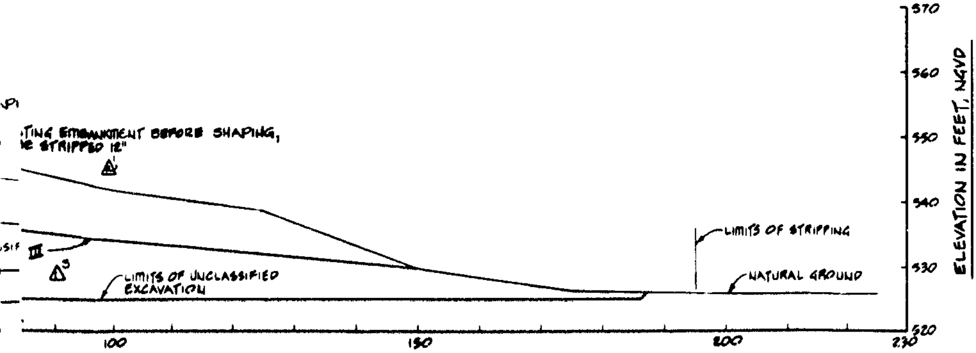
TYPICAL EXCAVATION SECTIC



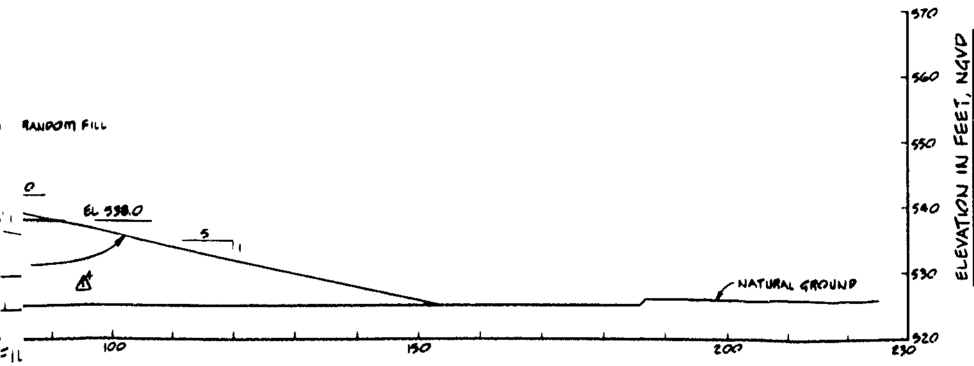
TYPICAL COMPACTED RANDOM FIL

1 2 3 4 5
F E D C B A

5 6 7 8 9



CAL EXCAVATION SECTION



MPACTED RANDOM FILL SECTION

10 0 10 20 30

SCALE IN FEET 1"=10'-0"

NOTES.

1. PHASE I EXCAVATION SH
PHASE II EXCAVATION, A
COMPLETED PRIOR TO ST

2. TOTAL WORK REQUIRED
FILL BACK TO EL 561.4

3. PHASE IV COMPACTED F
CALENDAR DAYS AFTER

4. LIMITS OF UNCLASSIFIED
FILL PLACEMENT WILL VA

5. ACTUAL LIMITS WILL VARY

2	C 2841	CO# P00001	7AP
1	-	AMP#000	IFF

DESIGNED BY: C SANCHEZ

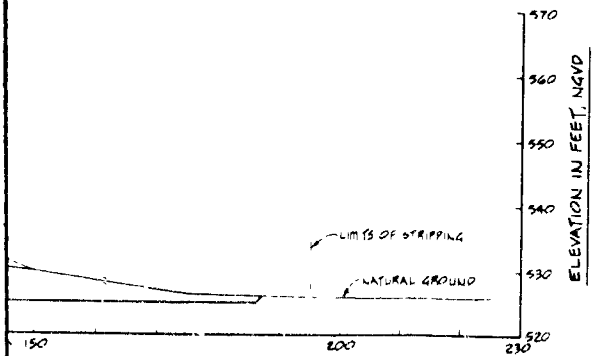
DRAWN BY: RL HILL

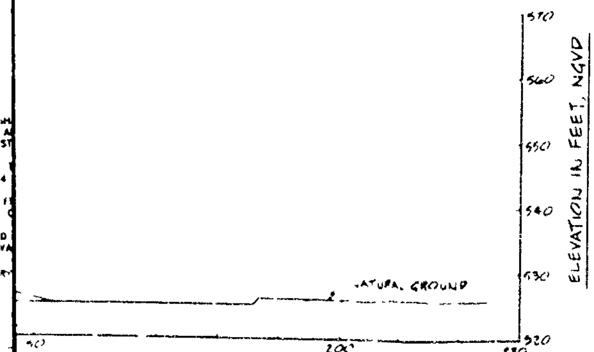
CHECKED BY: J WISE

SUBMITTED BY: H KARBS

SUPERC

5 6 7 8





NOTES

1 PHASE I EXCAVATION SHALL BE COMPLETED PRIOR TO STARTING PHASE II EXCAVATION, AND PHASE II EXCAVATION SHALL BE COMPLETED PRIOR TO STARTING PHASE III EXCAVATION

2 TOTAL WORK REQUIRED TO EXCAVATE AND PLACE COMPACTED FILL BACK TO EL 561 4 SHALL NOT EXCEED 30 CALENDAR DAYS

3 PHASE IV COMPACTED FILL SHALL BE COMPLETED WITHIN 7 CALENDAR DAYS AFTER COMPLETION OF PHASE III EXCAVATION

4 LIMITS OF UNCLASSIFIED EXCAVATION AND COMPACTED RANDOM FILL PLACEMENT WILL VARY IN TRANSITION AREAS

5. ACTUAL LIMITS WILL VARY BASED ON FIELD CONDITIONS

B	C 204	CO# P0001	7APR89	GENERAL REVISIONS
A	-	AM#0001	1FEB89	REVISED TO REFLECT W.I. CHANGES
		LETTER	DATE	DESCRIPTION OF REVISION

U.S. ARMY ENGINEER DISTRICT FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY: C SANCHEZ
DRAWN BY: R L HILL
REVIEWED BY: J W SE
SUBMITTED BY: H KARBS
ENGINEER

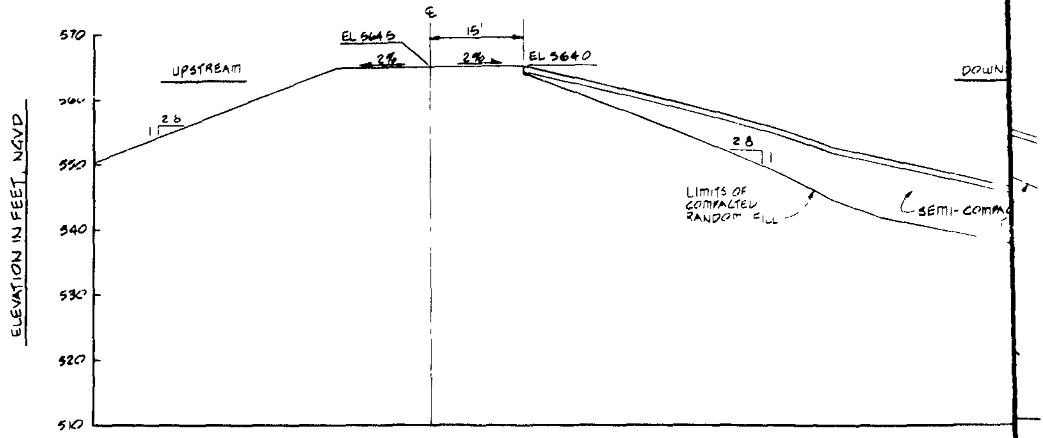
JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

EMBANKMENT SLIDE REPAIR

TYPICAL REPAIRS SECTIONS

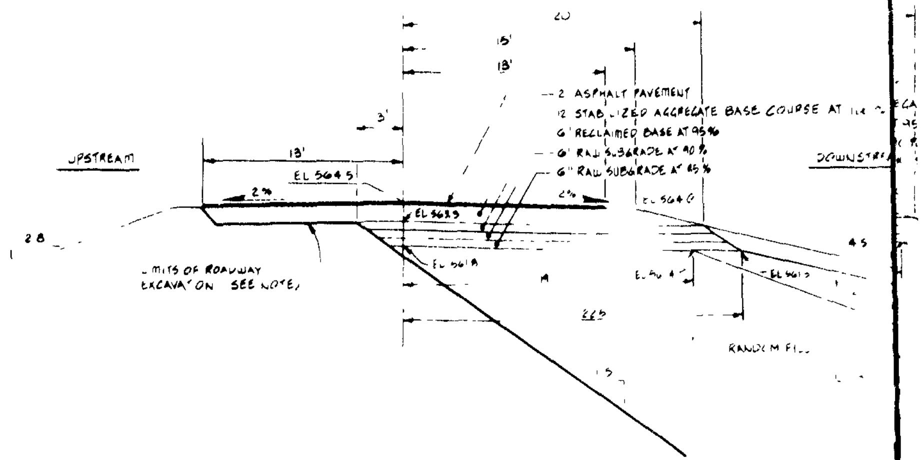
SOL NO DACW63 89 B 0097 DATE JAN 89
CONTRACT NO. DACW63 89 C 0058
DRAWING NUMBER
SHEET NO. 47
SEQUENCE NO. 4
CONTRACT NO DACW63 89 C 0058

SUPPLEMENT SHEET 4 PLATE 103



TYPICAL SEMI-COMPACT

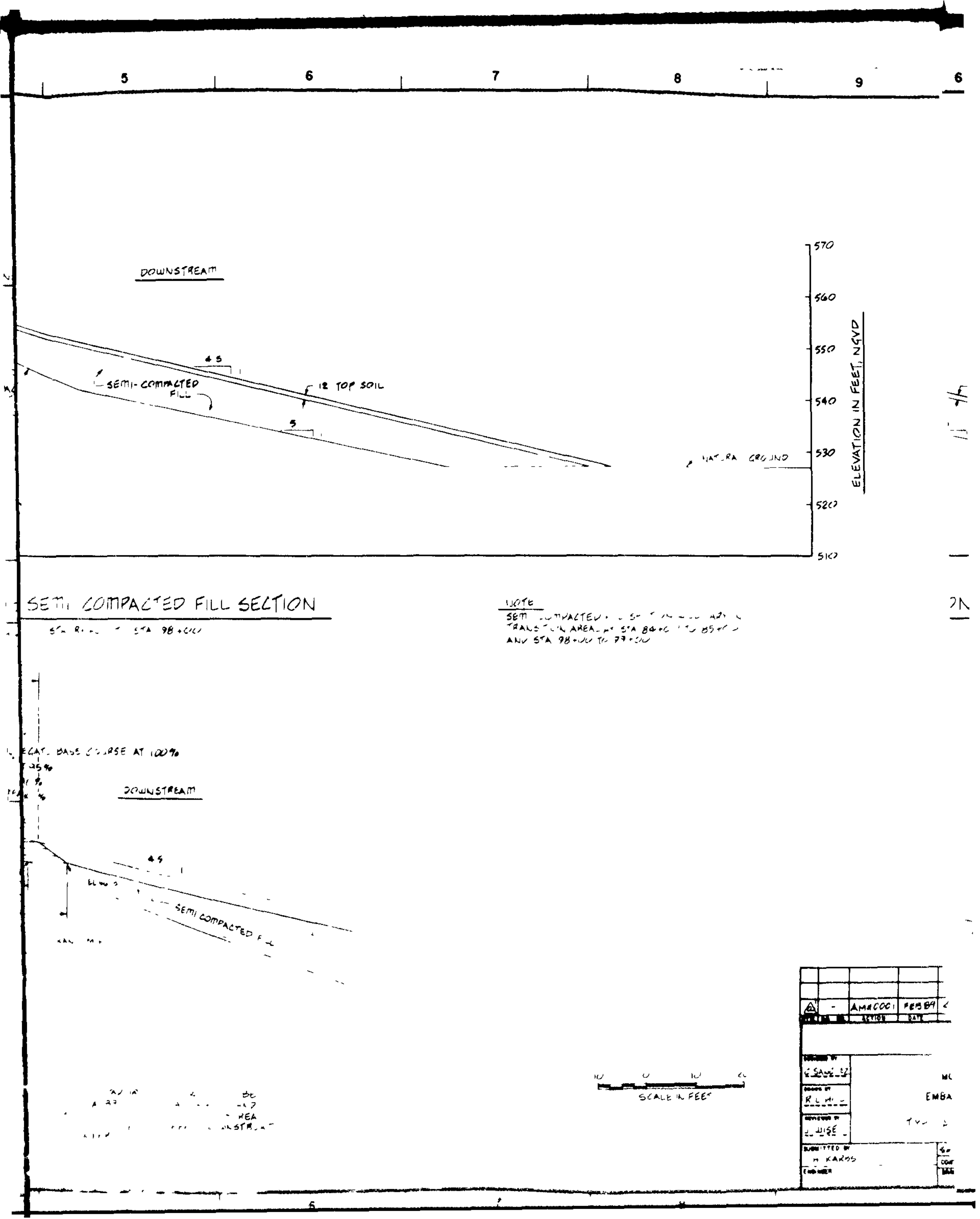
STA 85+0 TO STA



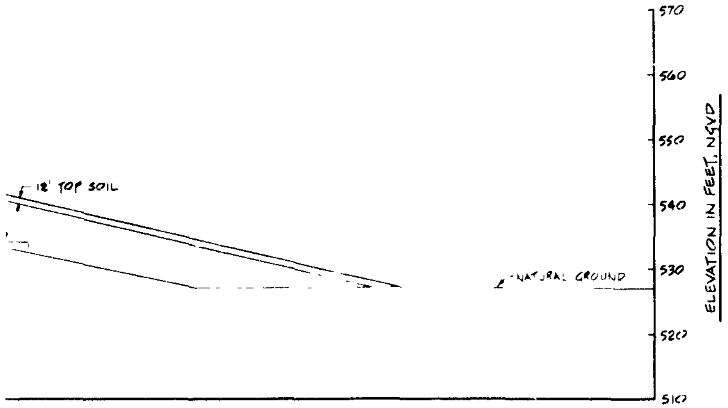
TYPICAL CROWN AND EMBANKMENT ROAD

STA 90+00 TO STA 93+00

NTS


5
6
7
8
9
DOWNSTREAM
SEMI-COMPACTED FILL
12 TOP SOIL
4.5
5
570
560
550
540
530
520
510
ELEVATION IN FEET, NGVD
SEMI COMPACTED FILL SECTION
STA 98+00
NOTE
SEMI COMPACTED
TRANSITION AREA AT STA 84+0 TO 85+0
AND STA 98+00 TO 99+00
BASE COURSE AT 100%
DOWNSTREAM
4.5
SEMI COMPACTED F
SCALE IN FEET
10
0
10
20
AMACO01
FEB 89
ACTION
DATE
R L H
WISE
SUBMITTED BY
H KAROS
ENGINEER
EMBA

6 7 8 9 10



?N

NOTE
SETT. COMPACTED FILL SECTION ... VARY ... TRANS... AREA AT STA 84+00 TO 85+00 AND STA 98+00 TO 99+00

10 0 10 20
SCALE IN FEET

1	-	AM#0001	1FEB89	REVISED TO REFLECT W I CHANGES
SYMBOL		ACTION	DATE	DESCRIPTION OF REVISION

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY: C SANCHEZ
DRAWN BY: R L HILL
REVIEWED BY: J WISE
SUBMITTED BY: H KARBS
ENGINEER

JOE POOL LAKE
MOUNTAIN CREEK, TEXAS

EMBANKMENT SLIDE REPAIR

TYPICAL SECTION ... GROUND

SOL NO DACW63 89-B-0097 DATE JAN 1989
CONTRACT NO DACW63 89 C-0058
DRAWING NUMBER
SHEET NO. 3

CONTRACT NO. DACW63 89-C-0058

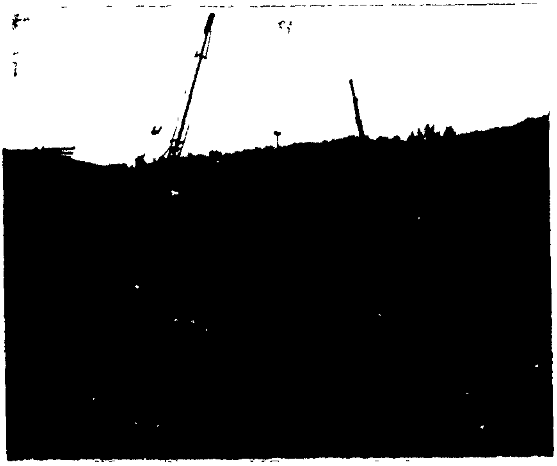


Photo No.1 Initial Contract 20 Mar 81
View along outlet works conduit showing protective concrete and steel placement. Note block-outs for conduit bottom collars and mobile excavation templates.

Photo No. 2 Initial Contract 20 Mar 81
View of outlet works steel for conduit invert.

CORPS OF ENGINEERS U S ARMY

Photo No. 3 Initial Contract 5 Aug 81
View of outlet works conduit and backfill. Note also the thin coal tar epoxy coated steel alignment conduit collars. Steel collars were 1" thick by 2'-0" wide. All joints were waterstopped. A 1/2" by 2'-0" neoprene backing was used for the steel collars.

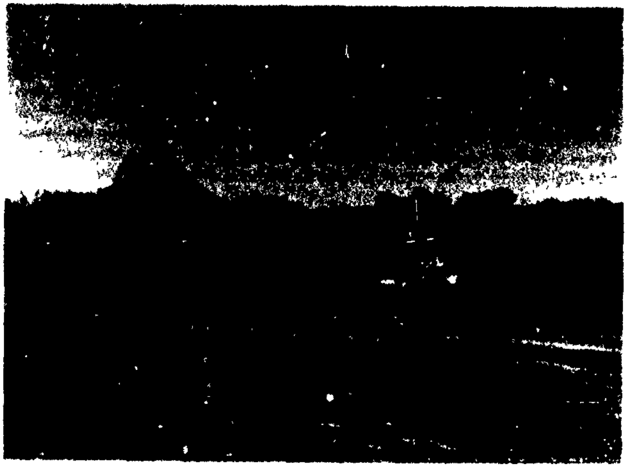


Photo No. 4 Initial Contract 16 Dec 80
View of Holland loader used for borrow excavation.

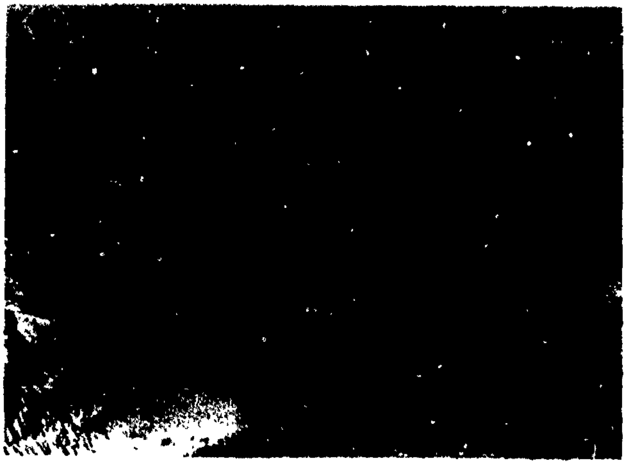


Photo No. 5 Completion Contract 15 Sep 82
View from right abutment along embankment centerline. Note deep inspection trench in foreground.

Photo No. 6 Completion Contract 15 Sep 82
View of Holland loader excavation operation in borrow area.

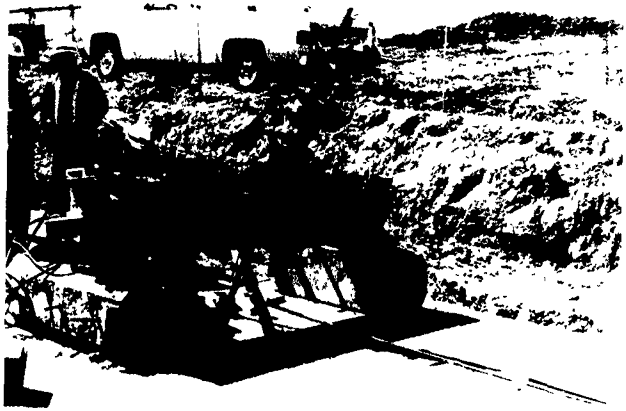


Photo No. 7 Completion Contracat 15 Apr 83
Anchor pull-out test on spillway chute. Anchor is No. 11 rebar (60 ksi) grouted in 6-inch diameter hole. Auchor lengths were 21 feet in the outlet works and 15 feet in the spillway.

Photo No. 8 Completion Contract 26 Jan 84
View east from sta. 96+. Note disc plows being pulled by rubber-tired tractor and by dozers, and the use of end dumps and belly dumps for hauling.

Photo No. 9 Completion Contract 9 Mar 84
Typical embankment surface drainage system pipe and impact basin (sta. 59±)

Photo No. 10 Completion Contract 9 Apr 84
View looking easterly at typical compaction operation using towed tamping rollers.

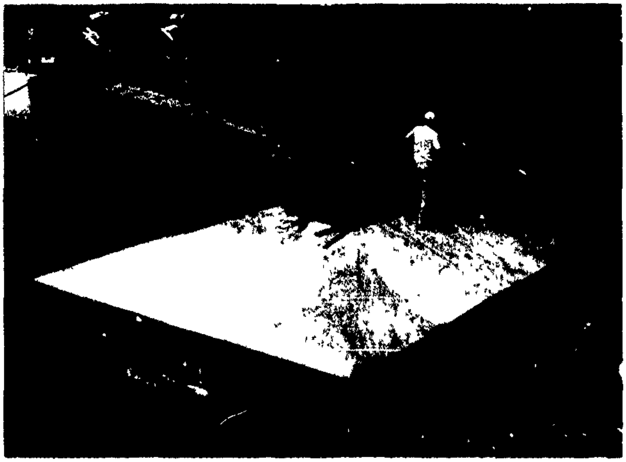


Photo No. 11 Completion Contract 25 Jul 84
View of outlet works tower bridge pier footing.

Photo No. 12 25 Jul 84

Completion Contract

View of outlet works tower. Note concrete placement for service bridge piers.

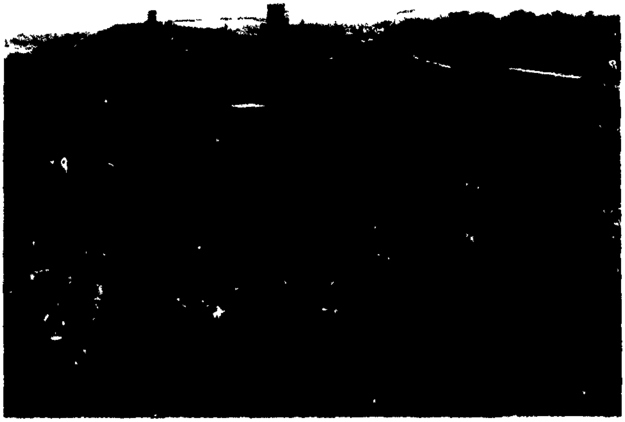


Photo No. 13 Completion Contract 25 Jul 84
View looking easterly at broadcrested spillway and chimney drain construction. Outlet works is visible in background.

Photo No. 14 Completion Contract 22 Sep 84
Muck removal in D/S portion of diversion channel in the closure section. Downstream plug is visible at far left background.

Photo No. 15 Completion Contract 22 Sep 84
View of borrow area scraper operation. Note water wagon being used to pre-wet materials. Pre-wetting was not a typical practice, but when used, it greatly reduced the required amount of moisture adjustment necessary at the embankment.

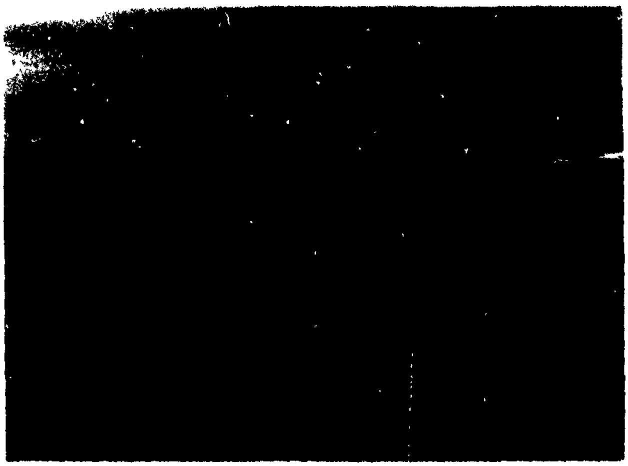


Photo No. 16 Completion Contract 7 Nov 84
View looking westerly at U/S cofferdam construction.

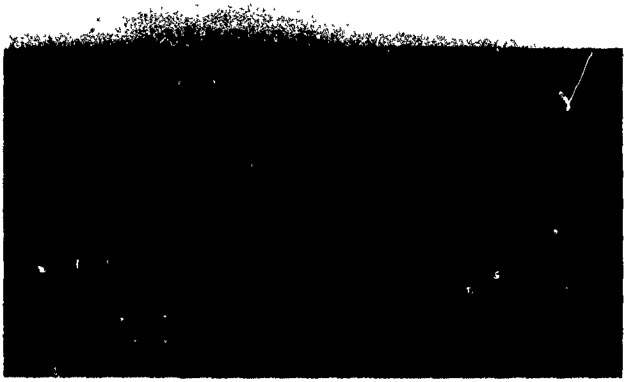


Photo No. 17 Completion Contract 13 Feb 85
View easterly at fill placement operations during embankment closure. Note well organized placement, discing, and compaction occurring concurrently at different locations.

Photo No. 18 Completion Contract 1 Apr 85
View looking easterly at embankment closure operations. Note larger body of water upstream is a portion of Borrow Area "A" that was excavated too deep to drain.

Photo No. 19 Completion Contract 1 Apr 85
View looking easterly showing spillway, outlet works, closure section, and ponded water in some upstream borrow areas.

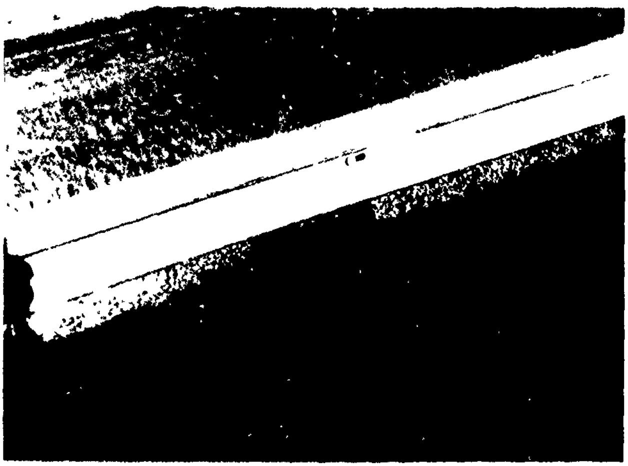


Photo No.20 12 Feb 87
Improper backfilling around guard rail post on crest of dam. This was typical. If uncorrected, it would provide a means for surface water to enter the fill.

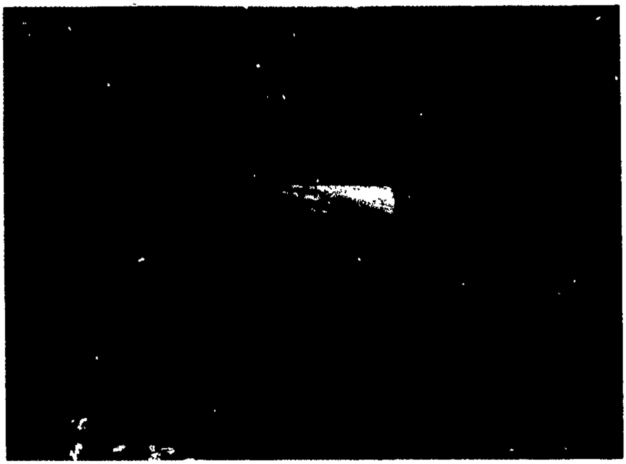


Photo No. 21 12 Feb 87
View looking up spillway chute. Weir length at crest is 50 feet.

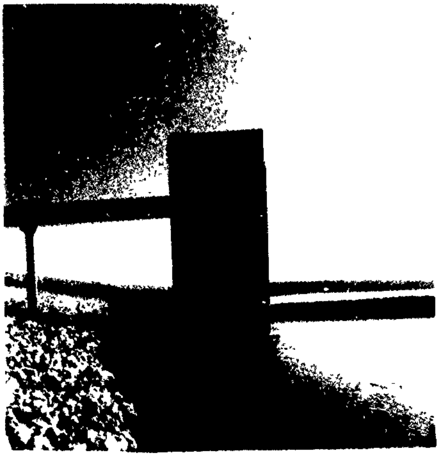


Photo No 22 12 Feb 87
View of outlet works tower with water impoundment at Elev. 503.6 or 18.4 feet below conservation pool.